JAPANESE [JP,11-069431,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

CLAIMS

[Claim(s)]
[Claim 1] In the system which carries out data transmission by the time-sharing TDMA channel between a base station and two or more migration machines a migration machine It has a call origination transmitting means to add the quality information showing the rate and quality of data transmission to a base station, and to perform a call request. A base station It has immobilization and an adjustable slot secured means to secure a predetermined fixed allocation slot and a predetermined adjustable allocation slot, into one frame. The number calculation step of fixed slots which computes the 1st number of slots to which the minimum transmission speed is satisfied from the above-mentioned quality information in the call request from a migration machine, The number calculation step of adjustable slots which computes the 2nd [which can be assigned] number of slots which satisfies the above-mentioned quality information from the above-mentioned migration machine, The fixed-slot secured step which secures the number of slots computed at the above-mentioned number calculation step of fixed slots first to a fixed allocation slot, It has the adjustable slot secured step which secures the adjustable slot corresponding to the number of slots computed at the above-mentioned number calculation step of adjustable slots when there was an empty slot. The TDMA adjustable slot allocation approach which notifies a secured result to the above-mentioned migration machine, and is characterized by processing the data of the above-mentioned immobilization from a corresponding migration machine, and both adjustable slots.
[Claim 2] the sum of the number of adjustable slots required as the step which will release a corresponding fixed allocation slot and will be made into an empty slot if a base station has a disconnect request from a migration machine by the quality information of a residual migration machine — present — the TDMA adjustable slot allocation approach according to claim 1 characterized by to add the step which reassigns the adjustable slot of a migration machine with the above-mentioned disconnect request when [than the number of adjustable slots of business] more.
[Claim 3] A base station is the TDMA adjustable slot allocation approach according to claim 1 characterized by having the allocation list which memorizes a migration machine with a call request corresponding to required quality information, and deciding the adjustable slot of the migration machine which corresponds with reference to the above-mentioned allocation list in the adjustable slot secured step which secures the adjustable slot in each frame.
[Claim 4] A base station is replaced with the number calculation step of adjustable slots, and it has the number calculation step of Nakama adjustable slots which computes the 3rd number of slots corresponding to middle quality of the 1st number of slots to which the minimum transmission speed is satisfied, and the 2nd number of slots with which are satisfied of quality information. An adjustable slot secured step The TDMA adjustable slot allocation approach according to claim 1 characterized by securing the adjustable slot corresponding to the 3rd number of slots computed at the above-mentioned number calculation step of Nakama adjustable slots when the empty slot was in the adjustable slot.
[Claim 5] It is the TDMA adjustable slot allocation approach according to claim 1 that a migration machine will transmit a slot addition demand to a base station if the own amount of transmit data

exceeds a predetermined value, and a base station is characterized by re-calculating the slot addition demand from the above-mentioned migration machine at the number calculation step of adjustable slots based on this information if it receives, and resecuring an adjustable slot.

[Claim 6] It is the TDMA adjustable slot allocation approach according to claim 5 which a migration machine transmits the information on the number of the present use adjustable slots on the occasion of a slot addition demand, and is characterized by re-calculating a base station at the number calculation step of adjustable slots based on the above-mentioned number information of the present use adjustable slots from a corresponding migration machine, and resecuring an adjustable slot.

[Claim 7] A migration machine is equipped with a means to transmit the current amount of need transmit data. A base station If the current amount of need transmit data of each above-mentioned migration machine is supervised and the 1st threshold is exceeded The TDMA adjustable slot allocation approach according to claim 1 which will be characterized by making it decrease the number of adjustable slots to the above-mentioned migration machine if the number of adjustable slots to the above-mentioned migration machine which exceeded the threshold at the number of adjustable slots secured step is made to increase and it is less than the 2nd threshold.

[Claim 8] A base station is the TDMA adjustable slot allocation approach according to claim 7 characterized by securing the above-mentioned number of adjustable slots until it received the release acknowledge signal from the above-mentioned migration machine when decreasing the number of adjustable slots to a migration machine.

[Claim 9] It is the TDMA adjustable slot allocation approach according to claim 1 of having made the adjustable slot over the migration machine which corresponds if make it a migration machine suspend transmission by the adjustable slot when there is no transmit data, and a base station is equipped with a means detect the synchronization of the slot on which the transmit data from a migration machine rides, the above-mentioned synchronization is equipped with the step which detects separating more than the predetermined count of continuation and it detects the above-mentioned continuation step-out release, and carrying out as the description.

[Claim 10] A base station is the TDMA adjustable slot allocation approach according to claim 7 characterized by to change the 1st which supervises the amount of need transmit data of the above-mentioned migration machine, and the 2nd threshold, when the step which measures the increment in the adjustable several percent slot this number to a specific migration machine and the count of reduction directions within predetermined time amount is prepared and an increment and the count of reduction directions become beyond the set point.

[Claim 11] A base station is the TDMA adjustable slot allocation approach according to claim 1 or 7 characterized by making it increase the number of adjustable slots secured to a correspondence migration machine at an adjustable slot secured step, when it has a means to receive the transmit data from a migration machine and to detect an error to slot correspondence and the above-mentioned error more than a predetermined number is detected.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the adjustable allocation approach of a TDMA slot for the migration machine in each base station in the radio communications system which transmits an ATM cel using a TDMA (Time Division Multiple Access) method.
[0002]
[Description of the Prior Art] There are a fixed allocation method and an adjustable allocation method in the approach for each migration machine in the radio communications system using a TDMA method to assign a TDMA slot. In the digital cordless telephone represented by conventional digital cellular phone / land mobile radiotelephone system using a TDMA method, and conventional PHS (Personal Handyphone System), the above-mentioned fixed allocation approach which assigns a fixed number of specific TDMA slots fixed to each migration machine is taken. On the other hand, in next-generation cellular phone / land mobile radiotelephone system, in order to transmit the traffic which needs to be transmitting the ATM cel and the packet, consequently changes from adjustment with the broadband communication network represented by B-ISDN dynamically, it is made to correspond not only to the transmission quality of an allocation slot but to the traffic from which it changes for every migration machine, and the adjustable slot allocation which changes dynamically the above-mentioned allocation slot over a migration machine is needed.
[0003] By the conventional adjustable slot allocation approach, to the call of a connection mode, the specific slot in 1TDMA frame is assigned for every fixed/or specific frame number based on the demand from a migration machine in each TDMA frame, and there is a method which assigns the slot after the slot assigned to the call of a connection mode for every 1TDMA frame to the call of a connectionless mode. The adjustable slot allocation approach is shown in JP,9-18435,A. Below, the conventional approach is explained, referring to drawing 19 and 20.
[0004] Drawing 19 is drawing showing the TDMA frame structure in the 1st conventional example. One frame is a fixed length and consists of two or more slots (slot of X individual). It is an as opposed to [get down, are a circuit (Down Link) and] base station from migration machine in the second half going-up circuit (Up Link) to the migration machine from a base station the first half of a frame. It is the going-down control slot group used in order for a **** to get down and to transmit the control information over each migration machine from a base station the first half of a circuit, and consists of slots of Sc individual. It gets down, and the ATM cel transmission important point over a migration machine gets down from a base station, and it is a data slot group and consists of slots of Su individual the second half of a circuit. Moreover, it is a going-up circuit to the base station from a migration machine, and the head of the going-up circuit concerned is a slot group for random access used in order to transmit the control data to a base station from a migration machine, and consists of fixed-length slots of Tr individual the second half of an above-mentioned frame. Moreover, the slot group following the slot group for random access is an object for abbey rubble bit rates (ABR), and is constituted by the slot of Ta individual. The slot group following the slot group for ABR is an object for variable bit rates (VBR), and is constituted by the slot of Tv individual. There is a slot group for fixed rates (CBR)

in the last of an above-mentioned frame, and it is constituted by the slot of Tc individual. Although all the slots X in a frame are fixed and the sum total of Sc, Su, Tr, Ta, Tv, and Tc always serves as X, the number Sc, Su, Tr, Ta, Tv, and Tc of each slot groups is changed by the control section of a base station with each frame according to traffic. Furthermore, the super frame which consists of two or more frames is also formed. Drawing 19 shows the condition of having formed 1 super frame with 4TDMA frame.

[0005] Drawing 20 is an adjustable slot allocation processing flow Fig. in this 1st conventional example. Slot allocation actuation is explained using drawing 20 . In the above-mentioned base station control-section slot allocation section, the value of Sc and Su is computed from the transmit data in a base station, Tc is deduced fixed at the time of the call receptionist from a migration machine, and Tr is set up with a fixed value. Moreover, as for the value of Tv, a peak rate is assigned to a fixed rate and ideal target not within one frame but within a super frame using the UPC (User Parameter Contorl) value at the time of a call receptionist. However, in each frame, a slot is not assigned fixed for every VBR call, but assignment of a slot is first accommodated between each VBR call, and it is fixed with subsequent super frames. In drawing 19 , the migration machine A and the migration machine B show the condition that slot allocation is accommodated to each other in each TDMA frame, and the condition that the slot is being fixed per super frame. That is, if it sees per each TDMA frame in a super frame, in each TDMA frame, the slot is assigned to adjustable so that the migration machine A and the migration machine B may guarantee the quality specified with the value by UPC so that the same slot of each other might not be assigned. On the other hand, the migration machine A and the slot allocation location to the migration machine B are immobilization, and the same slot is repeatedly assigned to a super frame unit per super frame. Finally, the value to which Ta lengthened the sum total of Sc, Su, Tr, Tv, and Tc from X is set up. Adjustable slot assignment is realized by updating once the slot location corresponding to Sc, Su, Tr, Ta, Tv, and Tc which were set up per frame as above to each frame thru/or several frames, and reporting it to each migration machine. In addition, about an above-mentioned ABR call, the slot of Ta individual is assigned to the migration machine demanded by the going-up control channel of each frame per frame.

[0006] Moreover, by the conventional adjustable slot allocation, the approach in consideration of the error of the wireless section is also taken into consideration, for example, it is shown in the Institute of Electronics, Information and Communication Engineers communication link society convention B-311 "examination of a centralized-control mold dynamic band quota method suitable for Wireless ATM" in 1996. Below, the 2nd conventional approach is explained, referring to drawing 21 .

[0007] Drawing 21 is a sequence diagram about the slot release by the adjustable slot allocation method in the 2nd conventional example in the wireless ATM communication system which used the TDMA method. By the wireless access method with which the TDMA method was used for the wireless ATM communication system using this sequence between a base station and one or more migration machines, it is the system which can transmit an ATM cel, the control line, i.e., the uphill control slot, and the going-down control slot according to individual are established for every migration machine between the base station and the migration machine, and a base station assigns two or more slots for data transmission within 1TDMA frame according to the demand from a migration machine to each migration machine. When it is judged that transmitting queue length is transmitted to a base station in each migration machine, and a base station has data beyond the slot assigned from the transmitting queue length of said migration machine to the migration machine in the transmitting queue of a migration machine Requiring allocation of a new slot of a base station using a control line, a base station chooses the slot according to the demand as other migration machines from a non-assigned slot, and notifies the allocation result of said slot to a requiring agency migration machine by the control line. On the other hand, when the data transmission from a migration machine is not N frame continuation, the approach the migration machine and the base station without transmit data release the slot by which data transmission was not made independently is proposed.

[0008]

[Problem(s) to be Solved by the Invention] By the conventional adjustable slot allocation method,

in order to transmit data in the slot location where it was set in the super frame period, it cannot respond to traffic fluctuation immediately, but the technical problem that a transit delay increases occurs. Moreover, in fixing the sending-out slot location completely or changing dynamically, in order to carry out at any time (every N (>=1) frame) by the control channel, when an error occurs in a control channel, slot assignment cannot be changed but the technical problem that circuit use effectiveness gets worse also occurs. Furthermore, when assigning a slot dynamically, in order to notify assignment of a slot location, i.e., the slot number, at the time of modification, the technical problem that the traffic of a control channel increases also occurs. Moreover, when a control channel is not concerned with the existence of an error, but it assigns k consecutive times conversely and there is no demand, in order to release, when control information is mistaken, a migration machine also has the technical problem that a slot will be released, even if there is transmit data. Furthermore, when resending control of ARQ etc. is used, if an error is in the received data in a base station, resending will surely take place and the queue length of a transmission buffer will be extended. However, since there was time lag by increment demand of an actual quota slot, the technical problem that a transit delay occurred also occurred.

[0009] It was made in order to cancel the above-mentioned technical problem, it corresponds to fluctuation traffic from a migration machine, and there is little delay, correspondence is quick, circuit use effectiveness is good, and this invention aims at acquiring the adjustable slot allocation approach of having stopped the traffic of a control channel.

[0010]

[Means for Solving the Problem] The TDMA adjustable slot allocation approach concerning this invention In the system which carries out data transmission by the time-sharing TDMA channel between a base station and two or more migration machines a migration machine It has a call origination transmitting means to add the quality information showing the rate and quality of data transmission to a base station, and to perform a call request. A base station It has immobilization and an adjustable slot secured means to secure a predetermined fixed allocation slot and a predetermined adjustable allocation slot, into one frame. The number calculation step of fixed slots which computes the 1st number of slots to which the minimum transmission speed is satisfied from the quality information in the call request from a migration machine, The number calculation step of adjustable slots which computes the 2nd [which can be assigned] number of slots which satisfies the quality information from a migration machine, The fixed-slot secured step which secures the number of slots computed at the number calculation step of fixed slots first to a fixed allocation slot, It has the adjustable slot secured step which secures the adjustable slot corresponding to the number of slots computed at the number calculation step of adjustable slots when the empty slot was in the adjustable slot. The data of the above-mentioned immobilization from the migration machine which notifies a secured result to a migration machine and is equivalent to it, and both adjustable slots were processed.

[0011] furthermore, the sum of the number of adjustable slots required as the step which will release a corresponding fixed allocation slot and will be made into an empty slot if a base station has a disconnect request from a migration machine by the quality information of a residual migration machine — present — when [than the number of adjustable slots of business] more, the step which reassigns the adjustable slot of a migration machine with a disconnect request was added.

[0012] Furthermore, a base station is equipped with the allocation list which memorizes a migration machine with a call request corresponding to required quality information, and determined the adjustable slot of the migration machine which corresponds with reference to an allocation list in the adjustable slot secured step which secures the adjustable slot of a frame.

[0013] A base station is replaced with the number calculation step of adjustable slots, and it has the number calculation step of Nakama adjustable slots which computes the 3rd number of slots corresponding to middle quality of the 1st number of slots to which the minimum transmission speed is satisfied, and the 2nd number of slots with which are satisfied of quality information. Furthermore, an adjustable slot secured step When the empty slot was in the adjustable slot, the adjustable slot corresponding to the 3rd number of slots computed at the number calculation

step of Nakama adjustable slots was secured.
[0014] Furthermore, the migration machine transmitted the slot addition demand to the base station, when the own amount of transmit data exceeded the predetermined value, and when the slot addition demand from a migration machine was received, a base station is re-calculated at the number calculation step of adjustable slots based on the information, and resecured the adjustable slot.
[0015] Furthermore, the migration machine transmitted the information on the number of the present use adjustable slots on the occasion of the slot addition demand, and a base station is re-calculated at the number calculation step of adjustable slots based on the above-mentioned number information of the present use adjustable slots from a corresponding migration machine, and resecured the adjustable slot.
[0016] Furthermore, the migration machine was equipped with a means to transmit the present amount of need transmit data, and when less [when the base station supervised the present amount of need transmit data of each migration machine and the 1st threshold was exceeded, the number of adjustable slots to the migration machine which exceeded the threshold at the number of adjustable slots secured step was made to increase, and] than the 2nd threshold, it was made to decrease the number of adjustable slots to a migration machine.
[0017] Furthermore, when decreasing the number of adjustable slots to a migration machine, the base station secured the number of adjustable slots until it received the release acknowledge signal from a migration machine.
[0018] Furthermore, the adjustable slot over the migration machine which corresponds if it is made for a migration machine to suspend transmission by the adjustable slot when there is no transmit data, and it has the step which detects a base station being equipped with a means to detect the synchronization of the slot to which the transmit data from a migration machine is transmitted, and separating more than the count of continuation predetermined in this synchronization and it detects continuation step-out was made to release.
[0019] Furthermore, the base station changed the 1st and the 2nd threshold which supervise the amount of need transmit data of a migration machine, when the step which measures the increment in this [adjustable slot several percent] over a specific migration machine and the count of reduction directions within predetermined time amount was prepared and the increment and the count of reduction directions became beyond the set point.
[0020] Furthermore, when the base station was equipped with a means to receive the transmit data from a migration machine and to detect an error to slot correspondence and these errors more than a predetermined number were detected, it was made to increase the number of adjustable slots secured to a correspondence migration machine at an adjustable slot secured step.
[0021]
[Embodiment of the Invention]
In gestalt 1. this invention of operation, the transmission demand from a migration machine is analyzed, it divides into the fixed slot for transmitting the minimum quality for transmission, and the adjustable slot added in order to transmit the desirable transmission quality, and fixed slots are not reduced during transmission in any situations, but an adjustable slot carries out increase and decrease of allocation according to the number of the demands from each migration machine, quality information, etc. Drawing 1 is drawing showing the example of the TDMA frame structure in this invention, and drawing 2 is drawing showing the processing flow of the slot allocation to the migration machine concerned at the time of call origination from the migration machine in a base station. Drawing 3 is drawing showing the processing flow about slot allocation modification for every frame in a base station, drawing 4 is drawing showing the processing flow of slot allocation modification at the time of the disconnect-request reception from the migration machine in a base station, and drawing 5 is drawing showing the example of the slot allocation situation in each frame. Hereafter, the example of the slot allocation approach in the base station of this invention is explained using drawing 1 - drawing 5 . The TDMA frame consists of a slot for vertical control channels, and a slot for user data as shown in drawing 1 . In addition, going up / partition from which it gets down does not have a user data slot, and it is dynamically

assigned to going up/going down in a base station. Moreover, it is common about the gestalt of each future operation not to carry out until a call ends modification after allocation about a fixed slot.
[0022] Next, the slot allocation approach at the time of the call origination from the migration machine in a base station is explained using drawing 2 . A migration machine performs a call request to a base station using an uphill control channel. A migration machine adds the quality information which a migration machine requires in that case, and is transmitted to a call-request message at it. quality information -- the minimum -- it is the information which shows a required transmission speed, average transmission, the maximum transmission speed, a permissible time delay, a waste ratio, etc. if a base station receives the call request from a migration machine (the name of a step is omitted step S0101 and henceforth) -- the quality information in the call origination message -- seeing (S0102) -- immediately -- a migration machine -- a communication link -- the minimum -- the inside of the required number of slots (S0103), and one frame -- max -- the required number of slots is computed (S0104).
[0023] the computed minimum -- it judges whether the required number of slots (Ns) can be assigned from a part for the opening in one frame (S0106), and when it can assign, it assigns the migration machine concerned as a fixed allocation slot (S0108). When it cannot assign, the call origination from the migration machine serves as call loss (S0107). Moreover, a migration machine computes the number of the maximum slots (Nr) used by one frame from the maximum transmission speed of the quality information in the call origination message concerned (S0104). When the number of the maximum slots can assign by the empty slot of an adjustable slot, the slot of a Nr-Ns individual is assigned to (S0109) and its migration machine as a slot which can be allocation changed. moreover -- the case where there is no slot of an individual allocation ** at the opening of an adjustable slot (Nr-Ns) -- (S0109:No) and all vacant adjustable slots -- as the slot of the migration machine which can be allocation changed -- allocation **** (S0110). The slot number of a fixed allocation slot and the slot which can be allocation changed is notified to the migration machine which the slot number corresponding to the number of slots computed as mentioned above was set up, got down, and advanced the call request using the control channel (S0115). In addition, it is also possible to carry out sequential use of the slot which can be allocation changed with each migration machine each frame by the approach which notifies only the slot number of a fixed allocation slot to each migration machine, and is described below.
[0024] How to perform use authorization of an adjustable allocation slot which provides the difference of demand quality and the minimum quality is explained to the migration machine with which the call request had a base station in each frame using drawing 3 . A base station computes the sum total (sigmaNt) of the slot which can be allocation changed in each frame (S0202). Next, it chooses out of the timing table beforehand created based on the quality information of the call origination message from each migration machine, and the migration machine which must perform data transmission in maximum velocity in a certain frame is chosen first (S0203). And the number of slots (Nr) which is equal to the maximum transmission speed of the selected migration machine is computed (S0204). If smaller than the sum total Nx of the number of slots of a total displacement machine while a difference with the slot Ns which is equal to this Nr and minimum transmission speed is communicating which can be allocation changed, same processing will be performed for the slot for Nr individual to that migration machine also to the next migration machine of allocation (S0206) and an allocation list (S0208). On the other hand, if Nr is larger than Nx, Nx will be assigned to the migration machine concerned as a slot which can be allocation changed (S0209). Here, an allocation list is created at the time of a call receptionist, and each migration machine is registered according to quality information for every period which assigns the slot over each migration machine which can be allocation changed. For this reason, as shown in drawing 5 , it transmits only by the fixed allocation slot and the use of the slot which can be allocation changed of a migration machine is usually attained in the frame registered into the allocation list. That is, only the number of the adjustable slots assigned for every migration machine may be changed when a frame moves. Moreover, you may make it investigate the demand quality of each migration machine in advance of allocation of an adjustable slot, although effectiveness worsens without having an allocation

list.
[0025] Next, the slot release approach at the time of the call clear-down from the migration machine in a base station is explained using drawing 4 . A base station computes the sum totals Ny (= sigmaNr (i)) of the number of demand quality (it is equivalent to maximum transmission speed) slots of the migration machine under communication link including (S0301) and its migration machine, when the disconnect request from the migration machine in an uphill control channel is received (S0302). After releasing the slot Ns assigned as a fixed allocation slot to the migration machine which sent out the disconnect request (S0303), When the sum total Nx (= sigmaNt) of the number of slots which can be allocation changed, and the sum total Ny (the number of slots of the migration machine is both also included) of the number of demand quality slots are in agreement, (S0304:Yes), It considers that the slot as demand quality is assigned to all migration machines including the migration machine, and all the slots of the migration machine concerned that can be allocation changed are released (S0305). On the other hand, since the number of slots from (S0304:No, i.e., demand quality) and the number of the actually permitted adjustable slots are not in agreement when Ny and Nx are not in agreement, the slot as demand quality is not assigned to one of migration machines. Therefore, the number of slots which fulfills demand quality to migration machines other than the migration machine concerned, and the number of slots which fulfills demand quality are not securable. Then, when the number of slots which fulfills demand quality can be secured from an empty slot, the slot which is equal to (S0307:Yes) and demand quality is used as the slot which can be allocation changed (S0309), and even when insufficient to the number of slots in which an empty slot rivals demand quality, let (S0307:No(es)) and all the adjustable empty slots be the slots which can be allocation changed (S0308). In this case, all or a part of slot currently assigned to the migration machine concerned is not released. in the phase which the processing to an allocation **** slot ended to the migration machine concerned, the migration machine concerned is deleted from an allocation list (S0310), degree frame gets down, and a cutting receptionist is transmitted to the migration machine concerned by the control channel (S0311).
[0026] Here, when a migration machine gets down normally, a control channel cannot be received and the check of transmitting authorization cannot be performed, data transmission will be performed only using a fixed allocation slot. Moreover, in drawing 1 or drawing 5 of a gestalt of this operation, what kind of pattern is sufficient about the relative position within the allocation slot of a fixed allocation slot and the slot which can be allocation changed. Moreover, although the number of fixed allocation slots is the number of slots which guarantees the minimum quality, it is good also considering the slot more than the case where resending control of ARQ etc. is carried out, and the number of slots which wireless circuit quality is inferior, and guarantees the minimum quality when the transmission quality of a control channel is bad as fixed allocation. In being able to perform allocation modification only by giving only transmitting authorization with each frame to each migration machine according to the approach of the gestalt 1 operation mentioned above, it can respond to traffic fluctuation flexibly by changing the count of sending-out authorization according to traffic, and a transit delay can be mitigated.
[0027] It was the approach of choosing a migration machine given [allocation of an adjustable slot] in an allocation list in order, and assigning from a head with the gestalt 1 of gestalt 2. implementation of operation. Here, how to assign an adjustable slot to a migration machine with a demand as impartially as possible is explained. Drawing 6 is a processing flow Fig. in the gestalt 2 of operation of the adjustable slot allocation approach of this invention, and shows the processing of slot allocation to the migration machine at the time of call origination from the migration machine in a base station. Drawing 7 is drawing showing the example of a slot allocation situation [in / for the processing flow Fig. about slot allocation modification for every frame in a base station / in drawing 8 / a certain frame]. Hereafter, the slot allocation approach by the base station in the gestalt of this operation is explained using drawing 1 and drawing 5 - drawing 8 .
[0028] First, the slot allocation processing to the migration machine at the time of the call origination in a base station becomes as it is shown in the following drawing 6 . By the uphill control channel, when the call origination receptionist from a migration machine is received, a

base station computes the number Nr of slots equivalent to (S0101), the number Ns of slots with which it is satisfied of the minimum quality from analysis (S0102) of the demand quality in a call origination message with the processing shown with the gestalt 1 of operation, and the maximum transmission speed (S0103, S0104), and calculates the difference Nt of Nr and Ns (S0105). It becomes call loss when Ns cannot assign from an empty slot (S0107). Next, the difference Nt of the number Nr of slots and the number Ns of fixed allocation slots with which the number of slots which can be allocation changed is equivalent to the maximum transmission speed of the migration machine concerned, The difference Nv of the number of slots and the number Ns of fixed allocation slots equivalent to the average transmission obtained from the quality information of the migration machine concerned, And a total of S (=sigmaNt-Nv) of the difference of Nt and Nv of the migration machine of others under communication link is calculated (S0402), and it sets up with the relation between this S and an empty slot No. When the difference of Nt and Nv of the migration machine concerned is smaller than a total of S of the difference of Nt and Nv of other migration machines, the number of slots of (S0403:Yes) and the migration machine concerned which can be allocation changed assigns the number Nv (however, it is equivalent to average transmission by Ns+Nv) of slots equivalent to average transmission (S0404). On the contrary, rather than S, when the difference of Nt-Nv is large, the slot of a Nt-S individual is assigned to (S0403:No) and the migration machine concerned as a slot which can be allocation changed (S0410). However, if No+S is larger than Nv or Nt when the number of allocations of the above-mentioned both sides is larger than an empty slot No, No (in the case of Nv) (S0408) or No+S (in the case of Nt-S) will be assigned, but (S0413) it becomes call loss when Nv is larger than S+No (S0107). The number of allocation slots for every migration machine is set up by the above. Here, since a fixed allocation slot is not changed, the slot location in each frame is specified (S0416). About the slot which can be allocation changed, it is also possible to create an allocation list so that the slot number may be specified, and the same slot may not be used with the same frame for every migration machine while [slot] can be allocation changed, and it is also possible to set up only the number of slots by the approach of drawing 6 , and to determine the sending-out slot number for every frame by the following approaches.

[0029] Next, the adjustable slot allocation approach for the migration machine in each frame is explained using drawing 7 . Whenever a base station changes a frame, it computes the sum total Nx (=sigmaNt) of the number of slots which can be allocation changed (S0202), and it chooses the migration machine of a transmitting schedule from an allocation list with the frame concerned (S0501). When two or more migration machines are chosen, sum total (when two or more migration machines are chosen) sigmaNr of the demand quality Nr (the number of slots equivalent to the maximum transmission speed) of the selected migration machine is computed (S0502). When the sum total of the difference Nt with this demand quality Nr and Ns is larger than Nx, (S0503:No), The allocation [choosing one migration machine from an allocation list, and using the number of slots (Nxx (Nr/sigma Nr)) which the demand quality of the migration machine concerned to sum total sigmaNr of the whole demand quality is comparatively alike, and matches as the slot which can be allocation changed] (S0505) to the migration machine concerned It gets down and the slot number for Nxx (Nr/sigma Nr) individual is notified by the control channel (S0211). One by one, a migration machine is chosen from an allocation list (S0501), and the slot which can be allocation changed is set up by same count. On the other hand, when Nx is larger than sigmaNt, the slot which is equivalent to demand quality to all the migration machines in an allocation list with (S0503:Yes) and the frame concerned is assigned (S0206), it gets down and a control channel reports the slot number (S0211). the migration machine set up so that the slot near demand quality may transmit to the migration machine near the head of an allocation list with the same frame by the allocation list by the gestalt of this operation of allocation **** if the approach shown with the gestalt 1 of operation is used as shown in drawing 8 — receiving — the ratio of demand quality — responding — a slot — allocation ****. Moreover, although set up with the gestalt of this operation by the ratio to the sum of all the demand quality of the migration machine under communication link, the number of slots which can be allocation changed may be set up in the demand quality of each migration

machine to the sum of the demand quality of a migration machine which transmits with the same frame by the allocation list. Moreover, another mean value Nz of Nr and Ns is set up, and it is good also as Nt=Nz−Ns.

[0030] According to the slot allocation from a base station, a migration machine performs data transmission in the slot as which each TDMA frame was specified. In drawing 5 , the slot allocation situation in each frame of a specific migration machine is shown. With the gestalt of this operation, a super frame structure is not taken, but each TDMA frame gets down, and a base station notifies the operating slot number to a migration machine in a control channel as shown in drawing 5 . A base station opts for allocation of the slot which can be allocation changed in each TDMA frame by the above-mentioned approach, and a mobile station performs data transmission by the slot which got down and was specified by the control channel. For this reason, according to timing table sequence, each other's slot will be accommodated to each migration machine in each TDMA frame. Moreover, based on a traffic pattern, i.e., the demand quality, the minimum quality or average transmission, a permission transit delay, etc. from each migration machine, the number of allocation slots and an allocation TDMA frame period can set up accommodation of the slot freely for every migration machine, and it is not fixed per super frame like the conventional example. That is, it does not become allocation spacing depending on a super frame period. As for the migration machine B, in the migration machine A, in drawing 5 , allocation of the slot which can be allocation changed has appeared per 5TDMA frame to the slot which can be allocation changed appearing at intervals of an about 3 TDMA frame. Moreover, accommodation of a slot with other migration machines can also be made dynamic. Although a base station needs to generate the timing table (transmitting authorization table) which gives transmitting authorization here so that two or more migration machines with the same frame may not transmit in the slot currently shared Grouping of the migration machine to which the same slot is not assigned can be carried out, and the approach of specifying the group in whom the migration machine which has the longest queue in origin is contained in the transmission buffer queue length from a migration machine as a transmitting authorization migration machine group in the frame concerned can also be used. According to this approach, since the same slot can be shared with two or more migration machines, improvement in circuit use effectiveness can be aimed at.

[0031] Even if the gestalt 3. base station of operation assigns an adjustable slot based on the original call request of a migration machine, when time amount passes by the amount of the real transmission data from a migration machine, and the migration number of machines which shares a frame, the stagnation amount of data may increase depending on a migration machine. One of the square [this] method of this is explained. Drawing 9 is the processing flow Fig. showing the example of the adjustable slot allocation approach for every frame by the base station in the gestalt 3 of operation of this invention. Drawing 10 is a sequence diagram between the migration machine-base stations which show the sequence of slot reassignment. Hereafter, the slot allocation approach in the gestalt 3 of operation of this invention is explained using drawing 1 and drawing 9 − drawing 10 .

[0032] When the data which there are few slots which can be allocation changed and cannot be transmitted pile up, each mobile station goes up like drawing 10 , and transmits a new allocation demand using a control channel. A base station performs re-calculation of the number of allocation modification slots to the migration machine which received the demand based on the new allocation demand which received by the same processing as the time of a call setup and call clear-down. For example, there is much going-up traffic by which the migration machine is transmitted to a base station in the phase which sent out the call setup demand, and if only the number of slots equivalent to the minimum quality or average transmission is assigned to the migration machine, the migration machine concerned can require reassignment of the slot near demand quality by new allocation demand.

[0033] Drawing 9 explains the slot reassignment processing in a base station. First, a migration machine transmits a slot change request to a base station. Quality information, the number of slots newly assigned now, or the number of the maximum slots by which transmitting authorization was carried out until now is added to this message. If there is this information, a

base station can know a former value immediately and will follow it as the guide at the time of being an improvement. A base station computes demand quality (the number of slots equivalent to the maximum transmission speed) from quality information like the time of call origination, and calculates the difference Nz with the current number of allocation slots. The number of slots is changed by the same processing (S0404-S0416) as the gestalt 2 publication of the operation of this Nz to origin.

[0034] In the gestalt of this operation, when it gets down and control data cannot receive normally, a migration machine cannot perform modification of an allocation slot, and it does not change an allocation slot until it receives the acknowledge signal from an applicable migration machine also in a base station.

[0035] While being able to change the number of slots set up at the time of call origination based on the demand from a migration machine according to this approach, the imitation nature to the traffic fluctuation by sending-out authorization can also improve, and mitigation of a transit delay and improvement in circuit use effectiveness can plan.

[0036] Unlike the gestalt 1 of previous operation thru/or 3, with the gestalt of gestalt 4. book implementation of operation, delivery and a base station explain [considerable information] allocation ****** for an adjustable slot to the traffic fluctuation per unit time amount based on such information from each migration machine. Drawing 11 is the processing flow Fig. showing the adjustable slot allocation approach in the gestalt 4 of operation of this invention. Drawing 12 is a sequence diagram between the migration machine-base stations at the time of performing slot reassignment. Hereafter, the slot allocation approach in the gestalt of this operation is explained using drawing 1 and drawing 11 - drawing 12 .

[0037] Each migration machine measures the queue length of a transmission buffer in a frame unit or convention frame number. The amount of traffic inputted between this frame is added to the transmitting queue length immediately after uphill control signal transmission (x), and the going-up control channel of the following frame reports the transmitting queue length (x) which subtracted the traffic which is equal to the number of slots assigned to the migration machine concerned to a base station as shown in drawing 11 . In a base station, based on the transmitting queue length report from each migration machine, transmitting queue length chooses the migration machine which is over a threshold (Xi), and increases the number of slots of the migration machine which can be allocation changed. Next, queue length chooses the migration machine which is less than the threshold (Xd), and chooses the release schedule slot of the migration machine. The frame (or frame of one more frame after) concerned gets down, and release of a slot and allocation are performed using a control channel. Allocation modification is ended when the acknowledge signal from all migration machines is received. In addition, the ACK/NACK signal from a migration machine may be multiplexed into a user data slot. Moreover, the slot concerned is not changed into a release condition until a release acknowledge signal is received from a migration machine, when releasing a slot. That is, it does not carry out assigning the slot concerned to other migration machines in front of a release condition. This is the same treatment also when managing with the number of slots.

[0038] Next, the increase and decrease of processing of the number of allocation slots in a base station are explained using drawing 11 . A base station receives a report of the transmitting queue length from each migration machine using an uphill control channel (S0701). When the transmitting queue length of each migration machine is over the threshold (Xi), the number Nzp of slots corresponding to the increment (x-Xi) of transmitting queue length is computed (S0703), and it adds to the number of slots of the migration machine which can be allocation changed (S0704). An allocation slot location is notified to the migration machine henceforth by the same processing (S0404-S0415) as the notice of a transmitting slot to the migration machine in each frame shown with the gestalt 2 of operation (S0708). Moreover, when transmitting queue length is below a threshold (Xd), the number Nzm of slots corresponding to the decrement (Xd-x) of transmitting queue die length is computed (S0706), and it subtracts from the number of slots of the migration machine which can be allocation changed. In addition, when the slot number is notified to the migration machine as a slot which can be allocation changed at the time of a call setup, the slot number chooses and (S0707) gets down from a release slot to descending in the

assigned slot, and a base station is notified to the migration machine in a control channel (S0708). Moreover, when the approach of reporting the slot used to a migration machine in each frame is adopted, the number of slots to the migration machine which can be allocation changed is changed. In this case, in making it increase and decreasing the processing at the time of a call receptionist, it uses the processing at the time of call clear-down.
[0039] According to this approach, it is possible to make the number of allocation slots fluctuate corresponding to the transmitting queue of a migration machine, and since it follows in footsteps of a transmitting queue by the time delay for which it depended on the transmitting queue report period from the migration machine and the number of allocation slots can be changed, slot allocation which conformed with the traffic of each migration machine can be performed.
[0040] Gestalt 5. drawing 13 of operation is the sequence diagram showing slot release of the adjustable slot allocation approach in the gestalt 5 of operation of this invention, and drawing 14 is the flow Fig. of slot release processing of the adjustable slot allocation approach. Hereafter, the adjustable slot allocation approach in the gestalt of this operation is explained using drawing 1 and drawing 13 -14.
[0041] the conventional example also explained — as — a base station — setting — received data — receiving — N time continuation — reception — being unidentified (NAK) — if it transmits, an allocation slot is releasable, but a migration machine carries out N time continuous transmission, and an allocation slot will be released also when a base station fails in the data reception by the error of the wireless section etc. by N time continuation. Here, as shown in drawing 13 , a migration machine suspends transmission by the slot which can be allocation changed in case there is no transmit data (accepting it #3 in drawing 13). If it carries out like this, since a base station cannot take the synchronization of the slot concerned, a synchronization serves as a gap, and a different index from the error by CRC can be obtained. For example, the slot to which the base station carried out continuation N time observation of step-out transmits the notice which the next frame of the frame which started step-out [of eye N time] gets down, and releases the slot in the frame concerned which can be allocation changed in a control channel to the migration machine concerned. This approach can be used for all the approaches of setting up the transmitting slot of immobilization to a migration machine beforehand. Moreover, it is applicable to the notice in the case of the approach of reporting a transmitting slot in each frame, in the case of selection of the slot location (number) corresponding to the number of transmitting slots (the gestalten 1-4 of operation the number of slots which can be allocation changed).
[0042] The slot release processing by step-out [in a base station] is explained using drawing 14 . The transmitting queue length report from a migration machine is investigated (S0801), and transmitting queue length (Lq) performs (S0802:No) and the following processings, in being shorter than a threshold (Xp). First, a synchronization memorizes the slot number which caused the gap (S0805), and a base station inspects the condition in the front frame of the slot concerned. In a step-out case, a synchronization counts up the count of a gap (AS) also for the condition in a front frame (S0808). In addition, the conditions and the counts of step-out in a front frame other than the slot concerned are reset (S0806). When the count of step-out is larger than a threshold N, the number of slots which can be allocation changed is decreased by the number of slots concerned (S0809). However, since it is considered aggravation of wireless circuit quality when the transmitting queue length Lq is longer than a threshold Xp and, as for a synchronization, a gap occurs frequently, modification of the number of slots which can be allocation changed is not carried out (S0804). According to this approach, a migration machine does not perform any transmission by the slot concerned, when there is no transmit data (an idle signal is not transmitted, either), but it drops transmitting power. In this way, as for a base station, the slot concerned of the frame concerned is known by that it became step-out and there was no transmission from the migration machine. Therefore, a slot without transmit data is releasable from the allocation slot of the migration machine over a multiple frame. Moreover, if there is no transmit data from a migration machine even when release of the slot which can be allocation changed cannot be carried out, since control information has been mistaken on the way, a base station will release a slot autonomously and will be raised in circuit use

effectiveness.
[0043] Gestalt 6. drawing 15 of operation is the sequence diagram showing how to make a slot allocation change auxiliary based on the queue length of the transmission buffer in the example 6 of this invention, and drawing 16 is the slot allocation modification processing flow Fig. Hereafter, the slot allocation modification approach in the gestalt of this operation is explained using drawing 1 and drawing 15 -16.
[0044] A base station receives the transmitting queue length (x) from a migration machine to each frame thru/or every convention frame number (it is 1 time to n frames), as shown in drawing 15 . With the gestalt 4 of operation, the base station explained the increase and decrease of an approach of the number of slots to a migration machine which can be allocation changed based on the transmitting queue length which received. By the approach of the gestalt 4 this operation, if the relation of two thresholds (Xi, Xd) is $Xd<x<Xi$, modification of slot allocation will not be performed. However, when fluctuation of the input traffic to the transmitting queue in a migration machine is large (i.e., when [the case where the difference of a peak bit rate and an average bit rate is large, and when burst nature is strong input traffic]), allocation modification will take place frequently. If it does so, a data ****** condition is changed and made the condition that there is no transmit data, and a transmission buffer, and a quality of service may be unable to be protected. Moreover, also when a base station cannot choose a suitable threshold, it will be in the same condition. Furthermore, if modification of the number of allocation modification slots to a migration machine is increased frequently, fluctuation of the number of allocation slots to the load and other migration machines of a base station will become large. With the gestalt of this operation, in order to cope with these situations, a base station measures the count of allocation modification generated between the unit time amount T of each specific migration machine, extends spacing of the threshold for transmitting queue length of the migration machine with which the count of allocation modification became more than N time (Xi, Xd), and decreases allocation modification frequency.
[0045] This allocation modification frequency suitable-ized processing is explained using drawing 16 . A base station checks the timer which it has for every migration (S0901) machine, when a transmitting queue length report is received from a migration machine (S0902). An increment or reduction of the number of slots which can be allocation changed is carried out to the migration machine by the approach which showed whether transmitting queue length would be in thresholds Xd and Xi ($Xd<Lq<Xi$) when the timer is working with the gestalt 4 of operation when it inspected (S0905) and was out of a threshold, and a count counter value is added (S0906). Moreover, when the timer is not working, a timer is worked (S0903), and a counter value is reset (S0904). Next, when a counter value comes during timer operation more than N, in order to mean that there had been allocation modification of N time within T hours, Thresholds Xd and Xi are changed to Xd=Xd-am and Xi=Xi+an, respectively (S0908). The width of face of the value with which transmitting queue length is permitted can be made to be able to increase (S0908), and the modification frequency of the number of slots itself which can be allocation changed can be decreased as a result (S0909) which resets a receiving timer. According to this approach, since the frequency of the count of allocation modification can be reduced, the inclination to approach peak traffic also to a call with an intense traffic fluctuation period is taken, and data transmission can make a transit delay there be nothing. Furthermore, since the threshold for allocation modification is decided for every call, processing can be mounted, without also performing rationalization of a threshold dynamically and establishing a special case like a setup of the threshold for the high traffic of burst nature.
[0046] Gestalt 7. drawing 17 of operation is a sequence diagram which makes a slot allocation change using the resending demand of ARQ in the gestalt 7 of operation of this invention, and drawing 18 is the flow Fig. showing the slot allocation modification processing. Hereafter, the adjustable slot allocation approach in the gestalt of this operation is explained using drawing 17 and drawing 18 .
[0047] The sequence diagram shown in drawing 17 in case ARQ is carried out between the base station and the mobile station shows signs that the error occurred to the data of No.2, and 3 and 5, among the data (1-6) sent out from the migration machine. If an error is in received data when

ARQ is carried out, the data in the frame concerned at least have collected on the transmission buffer in the transmitting side (migration machine) for resending. So, in a base station side, the number of allocation slots can be quickly increased by reducing the threshold for transmitting-side queue length (Xd) based on the number of resending data computed from the data for a resending demand (sequence number etc.).
[0048] Allocation slot modification processing in the base station which is carrying out resending control (for example, ARQ) is explained using drawing 18 . If a base station receives the slot from a migration machine (S1001), CRC (Cyclic Redundancy Check) given to each slot will be calculated (S1002), and the existence of the error in the slot concerned will be inspected (S1003). However, although the conditions to which CRC is given per slot have indicated in drawing 18 , CRC may be given per data unit within a slot. When an error is detected by the receiving slot, the slot number with which the error was detected is memorized (S1005), and the number of slots with an error (m) is computed (S1006). Here, only a decreases Xi to which m makes the slot of a corresponding mobile station which can be allocation changed increase when larger than a threshold (a0) (S1008). (the gestalten 3 and 4 of operation described) Thus, if Xi is decreased, increment processing of the number of slots which can be allocation changed will progress promptly to the increment in the queue length (x) of the migration machine in the transmitting queue length report from the following migration machine. According to this approach, since the queue length of the transmission buffer for resending is extended, an allocation slot increases to increase of the queue length of a migration machine for a short time, and the transmitting delay by resending can be mitigated.
[0049]
[Effect of the Invention] As mentioned above, according to the approach of this invention, there is the following effectiveness. Since the fixed slot corresponding to the minimum transmission speed from a migration machine is assigned, each migration machine is effective in conforming for every frame, being able to perform transmission of demand quality, and circuit efficiency improving, when it is effective in a required communication link being securable and further generous.
[0050] Furthermore, since it was made to reassign when the opening was made into the adjustable slot by cutting, there is effectiveness which conforms to fluctuation of traffic and can improve transmission speed.
[0051] Furthermore, since an allocation list is used, there is effectiveness which can perform allocation of an adjustable slot quickly.
[0052] Furthermore, since middle quality was taken into consideration on the occasion of reservation of an adjustable slot, it is effective in the ability of each migration machine which is transmitting to secure an adjustable slot equally according to the demand quality.
[0053] Furthermore, since the adjustable slot was re-secured by the recurrence call demand, it is effective in conforming to change of a situation and being able to change transmission speed.
[0054] furthermore -- from a migration machine -- present -- business -- since the number of slots was also reported, it is effective in the reevaluation time amount in a base station being shortened, and readiness improving.
[0055] Furthermore, since each migration machine reported the information corresponding to the amount of present transmit data to be transmitted, it is effective in the ability to perform a setup of a fine transmission speed on time.
[0056] Furthermore, since reception of a release acknowledge signal does not release an adjustable slot, it has the effectiveness which prevents unprepared line disconnection.
[0057] Furthermore, since the cause of step-out and others was distinguished, in step-out, in case there are no transmission data, there is effectiveness whose deployment passes an adjustable slot to others and is possible.
[0058] Furthermore, since the count of increase and decrease of directions of the adjustable slot to a migration machine is supervised, it is effective in stopping the transmission speed of a corresponding migration machine appropriately, and reducing the amount of traffic of a control line, and raising the use effectiveness of a circuit.
[0059] Furthermore, since the amount of errors of the data from a migration machine is detected

and it was made for a migration machine to be resent to make an adjustable slot increase, the migration machine with an error is effective in the ability to shorten a transmission time.

[Translation done.]

* NOTICES *

TECHNICAL FIELD

[Field of the Invention] This invention relates to the adjustable allocation approach of a TDMA slot for the migration machine in each base station in the radio communications system which transmits an ATM cel using a TDMA (Time Division Multiple Access) method.

[Translation done.]

PRIOR ART

[Description of the Prior Art] There are a fixed allocation method and an adjustable allocation method in the approach for each migration machine in the radio communications system using a TDMA method to assign a TDMA slot. In the digital cordless telephone represented by conventional digital cellular phone / land mobile radiotelephone system using a TDMA method, and conventional PHS (Personal Handyphone System), the above-mentioned fixed allocation approach which assigns a fixed number of specific TDMA slots fixed to each migration machine is taken. On the other hand, in next-generation cellular phone / land mobile radiotelephone system, in order to transmit the traffic which needs to be transmitting the ATM cel and the packet, consequently changes from adjustment with the broadband communication network represented by B-ISDN dynamically, it is made to correspond not only to the transmission quality of an allocation slot but to the traffic from which it changes for every migration machine, and the adjustable slot allocation which changes dynamically the above-mentioned allocation slot over a migration machine is needed.
[0003] By the conventional adjustable slot allocation approach, to the call of a connection mode, the specific slot in 1TDMA frame is assigned for every fixed/or specific frame number based on the demand from a migration machine in each TDMA frame, and there is a method which assigns the slot after the slot assigned to the call of a connection mode for every 1TDMA frame to the call of a connectionless mode. The adjustable slot allocation approach is shown in JP,9-18435,A. Below, the conventional approach is explained, referring to drawing 19 and 20.
[0004] Drawing 19 is drawing showing the TDMA frame structure in the 1st conventional example. One frame is a fixed length and consists of two or more slots (slot of X individual). It is an as opposed to [get down, are a circuit (Down Link) and] base station from migration machine in the second half going-up circuit (Up Link) to the migration machine from a base station the first half of a frame. It is the going-down control slot group used in order for a **** to get down and to transmit the control information over each migration machine from a base station the first half of a circuit, and consists of slots of Sc individual. It gets down, and the ATM cel transmission important point over a migration machine gets down from a base station, and it is a data slot group and consists of slots of Su individual the second half of a circuit. Moreover, it is a going-up circuit to the base station from a migration machine, and the head of the going-up circuit concerned is a slot group for random access used in order to transmit the control data to a base station from a migration machine, and consists of fixed-length slots of Tr individual the second half of an above-mentioned frame. Moreover, the slot group following the slot group for random access is an object for abbey rubble bit rates (ABR), and is constituted by the slot of Ta individual. The slot group following the slot group for ABR is an object for variable bit rates (VBR), and is constituted by the slot of Tv individual. There is a slot group for fixed rates (CBR) in the last of an above-mentioned frame, and it is constituted by the slot of Tc individual. Although all the slots X in a frame are fixed and the sum total of Sc, Su, Tr, Ta, Tv, and Tc always serves as X, the number Sc, Su, Tr, Ta, Tv, and Tc of each slot groups is changed by the control section of a base station with each frame according to traffic. Furthermore, the super frame which consists of two or more frames is also formed. Drawing 19 shows the condition of having formed 1 super frame with 4TDMA frame.

[0005] Drawing 20 is an adjustable slot allocation processing flow Fig. in this 1st conventional example. Slot allocation actuation is explained using drawing 20 . In the above-mentioned base station control-section slot allocation section, the value of Sc and Su is computed from the transmit data in a base station, Tc is deduced fixed at the time of the call receptionist from a migration machine, and Tr is set up with a fixed value. Moreover, as for the value of Tv, a peak rate is assigned to a fixed rate and ideal target not within one frame but within a super frame using the UPC (User Parameter Contorl) value at the time of a call receptionist. However, in each frame, a slot is not assigned fixed for every VBR call, but assignment of a slot is first accommodated between each VBR call, and it is fixed with subsequent super frames. In drawing 19 , the migration machine A and the migration machine B show the condition that slot allocation is accommodated to each other in each TDMA frame, and the condition that the slot is being fixed per super frame. That is, if it sees per each TDMA frame in a super frame, in each TDMA frame, the slot is assigned to adjustable so that the migration machine A and the migration machine B may guarantee the quality specified with the value by UPC so that the same slot of each other might not be assigned. On the other hand, the migration machine A and the slot allocation location to the migration machine B are immobilization, and the same slot is repeatedly assigned to a super frame unit per super frame. Finally, the value to which Ta lengthened the sum total of Sc, Su, Tr, Tv, and Tc from X is set up. Adjustable slot assignment is realized by updating once the slot location corresponding to Sc, Su, Tr, Ta, Tv, and Tc which were set up per frame as above to each frame thru/or several frames, and reporting it to each migration machine. In addition, about an above-mentioned ABR call, the slot of Ta individual is assigned to the migration machine demanded by the going-up control channel of each frame per frame.
[0006] Moreover, by the conventional adjustable slot allocation, the approach in consideration of the error of the wireless section is also taken into consideration, for example, it is shown in the Institute of Electronics, Information and Communication Engineers communication link society convention B-311 "examination of a centralized-control mold dynamic band quota method suitable for Wireless ATM" in 1996. Below, the 2nd conventional approach is explained, referring to drawing 21 .
[0007] Drawing 21 is a sequence diagram about the slot release by the adjustable slot allocation method in the 2nd conventional example in the wireless ATM communication system which used the TDMA method. By the wireless access method with which the TDMA method was used for the wireless ATM communication system using this sequence between a base station and one or more migration machines, it is the system which can transmit an ATM cel, the control line, i.e., the uphill control slot, and the going-down control slot according to individual are established for every migration machine between the base station and the migration machine, and a base station assigns two or more slots for data transmission within 1TDMA frame according to the demand from a migration machine to each migration machine. When it is judged that transmitting queue length is transmitted to a base station in each migration machine, and a base station has data beyond the slot assigned from the transmitting queue length of said migration machine to the migration machine in the transmitting queue of a migration machine Requiring allocation of a new slot of a base station using a control line, a base station chooses the slot according to the demand as other migration machines from a non-assigned slot, and notifies the allocation result of said slot to a requiring agency migration machine by the control line. On the other hand, when the data transmission from a migration machine is not N frame continuation, the approach the migration machine and the base station without transmit data release the slot by which data transmission was not made independently is proposed.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] As mentioned above, according to the approach of this invention, there is the following effectiveness. Since the fixed slot corresponding to the minimum transmission speed from a migration machine is assigned, each migration machine is effective in conforming for every frame, being able to perform transmission of demand quality, and circuit efficiency improving, when it is effective in a required communication link being securable and further generous.
[0050] Furthermore, since it was made to reassign when the opening was made into the adjustable slot by cutting, there is effectiveness which conforms to fluctuation of traffic and can improve transmission speed.
[0051] Furthermore, since an allocation list is used, there is effectiveness which can perform allocation of an adjustable slot quickly.
[0052] Furthermore, since middle quality was taken into consideration on the occasion of reservation of an adjustable slot, it is effective in the ability of each migration machine which is transmitting to secure an adjustable slot equally according to the demand quality.
[0053] Furthermore, since the adjustable slot was re-secured by the recurrence call demand, it is effective in conforming to change of a situation and being able to change transmission speed.
[0054] furthermore -- from a migration machine -- present -- business -- since the number of slots was also reported, it is effective in the reevaluation time amount in a base station being shortened, and readiness improving.
[0055] Furthermore, since each migration machine reported the information corresponding to the amount of present transmit data to be transmitted, it is effective in the ability to perform a setup of a fine transmission speed on time.
[0056] Furthermore, since reception of a release acknowledge signal does not release an adjustable slot, it has the effectiveness which prevents unprepared line disconnection.
[0057] Furthermore, since the cause of step-out and others was distinguished, in step-out, in case there are no transmission data, there is effectiveness whose deployment passes an adjustable slot to others and is possible.
[0058] Furthermore, since the count of increase and decrease of directions of the adjustable slot to a migration machine is supervised, it is effective in stopping the transmission speed of a corresponding migration machine appropriately, and reducing the amount of traffic of a control line, and raising the use effectiveness of a circuit.
[0059] Furthermore, since the amount of errors of the data from a migration machine is detected and it was made for a migration machine to be resent to make an adjustable slot increase, the migration machine with an error is effective in the ability to shorten a transmission time.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] By the conventional adjustable slot allocation method, in order to transmit data in the slot location where it was set in the super frame period, it cannot respond to traffic fluctuation immediately, but the technical problem that a transit delay increases occurs. Moreover, in fixing the sending-out slot location completely or changing dynamically, in order to carry out at any time (every N (>=1) frame) by the control channel, when an error occurs in a control channel, slot assignment cannot be changed but the technical problem that circuit use effectiveness gets worse also occurs. Furthermore, when assigning a slot dynamically, in order to notify assignment of a slot location, i.e., the slot number, at the time of modification, the technical problem that the traffic of a control channel increases also occurs. Moreover, when a control channel is not concerned with the existence of an error, but it assigns k consecutive times conversely and there is no demand, in order to release, when control information is mistaken, a migration machine also has the technical problem that a slot will be released, even if there is transmit data. Furthermore, when resending control of ARQ etc. is used, if an error is in the received data in a base station, resending will surely take place and the queue length of a transmission buffer will be extended. However, since there was time lag by increment demand of an actual quota slot, the technical problem that a transit delay occurred also occurred.
[0009] It was made in order to cancel the above-mentioned technical problem, it corresponds to fluctuation traffic from a migration machine, and there is little delay, correspondence is quick, circuit use effectiveness is good, and this invention aims at acquiring the adjustable slot allocation approach of having stopped the traffic of a control channel.

[Translation done.]

MEANS

[Means for Solving the Problem] The TDMA adjustable slot allocation approach concerning this invention In the system which carries out data transmission by the time-sharing TDMA channel between a base station and two or more migration machines a migration machine It has a call origination transmitting means to add the quality information showing the rate and quality of data transmission to a base station, and to perform a call request. A base station It has immobilization and an adjustable slot secured means to secure a predetermined fixed allocation slot and a predetermined adjustable allocation slot, into one frame. The number calculation step of fixed slots which computes the 1st number of slots to which the minimum transmission speed is satisfied from the quality information in the call request from a migration machine, The number calculation step of adjustable slots which computes the 2nd [which can be assigned] number of slots which satisfies the quality information from a migration machine, The fixed-slot secured step which secures the number of slots computed at the number calculation step of fixed slots first to a fixed allocation slot, It has the adjustable slot secured step which secures the adjustable slot corresponding to the number of slots computed at the number calculation step of adjustable slots when the empty slot was in the adjustable slot. The data of the above-mentioned immobilization from the migration machine which notifies a secured result to a migration machine and is equivalent to it, and both adjustable slots were processed.
[0011] furthermore, the sum of the number of adjustable slots required as the step which will release a corresponding fixed allocation slot and will be made into an empty slot if a base station has a disconnect request from a migration machine by the quality information of a residual migration machine -- present -- when [than the number of adjustable slots of business] more, the step which reassigns the adjustable slot of a migration machine with a disconnect request was added.
[0012] Furthermore, a base station is equipped with the allocation list which memorizes a migration machine with a call request corresponding to required quality information, and determined the adjustable slot of the migration machine which corresponds with reference to an allocation list in the adjustable slot secured step which secures the adjustable slot of a frame.
[0013] A base station is replaced with the number calculation step of adjustable slots, and it has the number calculation step of Nakama adjustable slots which computes the 3rd number of slots corresponding to middle quality of the 1st number of slots to which the minimum transmission speed is satisfied, and the 2nd number of slots with which are satisfied of quality information. Furthermore, an adjustable slot secured step When the empty slot was in the adjustable slot, the adjustable slot corresponding to the 3rd number of slots computed at the number calculation step of Nakama adjustable slots was secured.
[0014] Furthermore, the migration machine transmitted the slot addition demand to the base station, when the own amount of transmit data exceeded the predetermined value, and when the slot addition demand from a migration machine was received, a base station is re-calculated at the number calculation step of adjustable slots based on the information, and resecured the adjustable slot.
[0015] Furthermore, the migration machine transmitted the information on the number of the present use adjustable slots on the occasion of the slot addition demand, and a base station is

re-calculated at the number calculation step of adjustable slots based on the above-mentioned number information of the present use adjustable slots from a corresponding migration machine, and resecured the adjustable slot.
[0016] Furthermore, the migration machine was equipped with a means to transmit the present amount of need transmit data, and when less [when the base station supervised the present amount of need transmit data of each migration machine and the 1st threshold was exceeded, the number of adjustable slots to the migration machine which exceeded the threshold at the number of adjustable slots secured step was made to increase, and] than the 2nd threshold, it was made to decrease the number of adjustable slots to a migration machine.
[0017] Furthermore, when decreasing the number of adjustable slots to a migration machine, the base station secured the number of adjustable slots until it received the release acknowledge signal from a migration machine.
[0018] Furthermore, the adjustable slot over the migration machine which corresponds if it is made for a migration machine to suspend transmission by the adjustable slot when there is no transmit data, and it has the step which detects a base station being equipped with a means to detect the synchronization of the slot to which the transmit data from a migration machine is transmitted, and separating more than the count of continuation predetermined in this synchronization and it detects continuation step-out was made to release.
[0019] Furthermore, the base station changed the 1st and the 2nd threshold which supervise the amount of need transmit data of a migration machine, when the step which measures the increment in this [adjustable slot several percent] over a specific migration machine and the count of reduction directions within predetermined time amount was prepared and the increment and the count of reduction directions became beyond the set point.
[0020] Furthermore, when the base station was equipped with a means to receive the transmit data from a migration machine and to detect an error to slot correspondence and these errors more than a predetermined number were detected, it was made to increase the number of adjustable slots secured to a correspondence migration machine at an adjustable slot secured step.
[0021]
[Embodiment of the Invention]
In gestalt 1. this invention of operation, the transmission demand from a migration machine is analyzed, it divides into the fixed slot for transmitting the minimum quality for transmission, and the adjustable slot added in order to transmit the desirable transmission quality, and fixed slots are not reduced during transmission in any situations, but an adjustable slot carries out increase and decrease of allocation according to the number of the demands from each migration machine, quality information, etc. Drawing 1 is drawing showing the example of the TDMA frame structure in this invention, and drawing 2 is drawing showing the processing flow of the slot allocation to the migration machine concerned at the time of call origination from the migration machine in a base station. Drawing 3 is drawing showing the processing flow about slot allocation modification for every frame in a base station, drawing 4 is drawing showing the processing flow of slot allocation modification at the time of the disconnect-request reception from the migration machine in a base station, and drawing 5 is drawing showing the example of the slot allocation situation in each frame. Hereafter, the example of the slot allocation approach in the base station of this invention is explained using drawing 1 - drawing 5 . The TDMA frame consists of a slot for vertical control channels, and a slot for user data as shown in drawing 1 . In addition, going up / partition from which it gets down does not have a user data slot, and it is dynamically assigned to going up/going down in a base station. Moreover, it is common about the gestalt of each future operation not to carry out until a call ends modification after allocation about a fixed slot.
[0022] Next, the slot allocation approach at the time of the call origination from the migration machine in a base station is explained using drawing 2 . A migration machine performs a call request to a base station using an uphill control channel. A migration machine adds the quality information which a migration machine requires in that case, and is transmitted to a call-request message at it. quality information -- the minimum -- it is the information which shows a required

transmission speed, average transmission, the maximum transmission speed, a permissible time delay, a waste ratio, etc. if a base station receives the call request from a migration machine (the name of a step is omitted step S0101 and henceforth) -- the quality information in the call origination message -- seeing (S0102) -- immediately -- a migration machine -- a communication link -- the minimum -- the inside of the required number of slots (S0103), and one frame -- max -- the required number of slots is computed (S0104).
[0023] the computed minimum -- it judges whether the required number of slots (Ns) can be assigned from a part for the opening in one frame (S0106), and when it can assign, it assigns the migration machine concerned as a fixed allocation slot (S0108). When it cannot assign, the call origination from the migration machine serves as call loss (S0107). Moreover, a migration machine computes the number of the maximum slots (Nr) used by one frame from the maximum transmission speed of the quality information in the call origination message concerned (S0104). When the number of the maximum slots can assign by the empty slot of an adjustable slot, the slot of a Nr-Ns individual is assigned to (S0109) and its migration machine as a slot which can be allocation changed. moreover -- the case where there is no slot of an individual allocation ** at the opening of an adjustable slot (Nr-Ns) -- (S0109:No) and all vacant adjustable slots -- as the slot of the migration machine which can be allocation changed -- allocation **** (S0110). The slot number of a fixed allocation slot and the slot which can be allocation changed is notified to the migration machine which the slot number corresponding to the number of slots computed as mentioned above was set up, got down, and advanced the call request using the control channel (S0115). In addition, it is also possible to carry out sequential use of the slot which can be allocation changed with each migration machine each frame by the approach which notifies only the slot number of a fixed allocation slot to each migration machine, and is described below.
[0024] How to perform use authorization of an adjustable allocation slot which provides the difference of demand quality and the minimum quality is explained to the migration machine with which the call request had a base station in each frame using drawing 3 . A base station computes the sum total (sigmaNt) of the slot which can be allocation changed in each frame (S0202). Next, it chooses out of the timing table beforehand created based on the quality information of the call origination message from each migration machine, and the migration machine which must perform data transmission in maximum velocity in a certain frame is chosen first (S0203). And the number of slots (Nr) which is equal to the maximum transmission speed of the selected migration machine is computed (S0204). If smaller than the sum total Nx of the number of slots of a total displacement machine while a difference with the slot Ns which is equal to this Nr and minimum transmission speed is communicating which can be allocation changed, same processing will be performed for the slot for Nr individual to that migration machine also to the next migration machine of allocation (S0206) and an allocation list (S0208). On the other hand, if Nr is larger than Nx, Nx will be assigned to the migration machine concerned as a slot which can be allocation changed (S0209). Here, an allocation list is created at the time of a call receptionist, and each migration machine is registered according to quality information for every period which assigns the slot over each migration machine which can be allocation changed. For this reason, as shown in drawing 5 , it transmits only by the fixed allocation slot and the use of the slot which can be allocation changed of a migration machine is usually attained in the frame registered into the allocation list. That is, only the number of the adjustable slots assigned for every migration machine may be changed when a frame moves. Moreover, you may make it investigate the demand quality of each migration machine in advance of allocation of an adjustable slot, although effectiveness worsens without having an allocation list.
[0025] Next, the slot release approach at the time of the call clear-down from the migration machine in a base station is explained using drawing 4 . A base station computes the sum totals Ny (= sigmaNr (i)) of the number of demand quality (it is equivalent to maximum transmission speed) slots of the migration machine under communication link including (S0301) and its migration machine, when the disconnect request from the migration machine in an uphill control channel is received (S0302). After releasing the slot Ns assigned as a fixed allocation slot to the migration machine which sent out the disconnect request (S0303), When the sum total Nx (=

sigmaNt) of the number of slots which can be allocation changed, and the sum total Ny (the number of slots of the migration machine is both also included) of the number of demand quality slots are in agreement, (S0304:Yes), It considers that the slot as demand quality is assigned to all migration machines including the migration machine, and all the slots of the migration machine concerned that can be allocation changed are released (S0305). On the other hand, since the number of slots from (S0304:No, i.e., demand quality) and the number of the actually permitted adjustable slots are not in agreement when Ny and Nx are not in agreement, the slot as demand quality is not assigned to one of migration machines. Therefore, the number of slots which fulfills demand quality to migration machines other than the migration machine concerned, and the number of slots which fulfills demand quality are not securable. Then, when the number of slots which fulfills demand quality can be secured from an empty slot, the slot which is equal to (S0307:Yes) and demand quality is used as the slot which can be allocation changed (S0309), and even when insufficient to the number of slots in which an empty slot rivals demand quality, let (S0307:No(es)) and all the adjustable empty slots be the slots which can be allocation changed (S0308). In this case, all or a part of slot currently assigned to the migration machine concerned is not released. in the phase which the processing to an allocation **** slot ended to the migration machine concerned, the migration machine concerned is deleted from an allocation list (S0310), degree frame gets down, and a cutting receptionist is transmitted to the migration machine concerned by the control channel (S0311).

[0026] Here, when a migration machine gets down normally, a control channel cannot be received and the check of transmitting authorization cannot be performed, data transmission will be performed only using a fixed allocation slot. Moreover, in drawing 1 or drawing 5 of a gestalt of this operation, what kind of pattern is sufficient about the relative position within the allocation slot of a fixed allocation slot and the slot which can be allocation changed. Moreover, although the number of fixed allocation slots is the number of slots which guarantees the minimum quality, it is good also considering the slot more than the case where resending control of ARQ etc. is carried out, and the number of slots which wireless circuit quality is inferior, and guarantees the minimum quality when the transmission quality of a control channel is bad as fixed allocation. In being able to perform allocation modification only by giving only transmitting authorization with each frame to each migration machine according to the approach of the gestalt 1 operation mentioned above, it can respond to traffic fluctuation flexibly by changing the count of sending-out authorization according to traffic, and a transit delay can be mitigated.

[0027] It was the approach of choosing a migration machine given [allocation of an adjustable slot] in an allocation list in order, and assigning from a head with the gestalt 1 of gestalt 2. implementation of operation. Here, how to assign an adjustable slot to a migration machine with a demand as impartially as possible is explained. Drawing 6 is a processing flow Fig. in the gestalt 2 of operation of the adjustable slot allocation approach of this invention, and shows the processing of slot allocation to the migration machine at the time of call origination from the migration machine in a base station. Drawing 7 is drawing showing the example of a slot allocation situation [in / for the processing flow Fig. about slot allocation modification for every frame in a base station / in drawing 8 / a certain frame]. Hereafter, the slot allocation approach by the base station in the gestalt of this operation is explained using drawing 1 and drawing 5 - drawing 8 .

[0028] First, the slot allocation processing to the migration machine at the time of the call origination in a base station becomes as it is shown in the following drawing 6 . By the uphill control channel, when the call origination receptionist from a migration machine is received, a base station computes the number Nr of slots equivalent to (S0101), the number Ns of slots with which it is satisfied of the minimum quality from analysis (S0102) of the demand quality in a call origination message with the processing shown with the gestalt 1 of operation, and the maximum transmission speed (S0103, S0104), and calculates the difference Nt of Nr and Ns (S0105). It becomes call loss when Ns cannot assign from an empty slot (S0107). Next, the difference Nt of the number Nr of slots and the number Ns of fixed allocation slots with which the number of slots which can be allocation changed is equivalent to the maximum transmission speed of the migration machine concerned, The difference Nv of the number of slots and the number Ns of

fixed allocation slots equivalent to the average transmission obtained from the quality information of the migration machine concerned, And a total of S (=sigmaNt-Nv) of the difference of Nt and Nv of the migration machine of others under communication link is calculated (S0402), and it sets up with the relation between this S and an empty slot No. When the difference of Nt and Nv of the migration machine concerned is smaller than a total of S of the difference of Nt and Nv of other migration machines, the number of slots of (S0403:Yes) and the migration machine concerned which can be allocation changed assigns the number Nv (however, it is equivalent to average transmission by Ns+Nv) of slots equivalent to average transmission (S0404). On the contrary, rather than S, when the difference of Nt-Nv is large, the slot of a Nt-S individual is assigned to (S0403:No) and the migration machine concerned as a slot which can be allocation changed (S0410). However, if No+S is larger than Nv or Nt when the number of allocations of the above-mentioned both sides is larger than an empty slot No, No (in the case of Nv) (S0408) or No+S (in the case of Nt-S) will be assigned, but (S0413) it becomes call loss when Nv is larger than S+No (S0107). The number of allocation slots for every migration machine is set up by the above. Here, since a fixed allocation slot is not changed, the slot location in each frame is specified (S0416). About the slot which can be allocation changed, it is also possible to create an allocation list so that the slot number may be specified, and the same slot may not be used with the same frame for every migration machine while [slot] can be allocation changed, and it is also possible to set up only the number of slots by the approach of drawing 6 , and to determine the sending-out slot number for every frame by the following approaches.

[0029] Next, the adjustable slot allocation approach for the migration machine in each frame is explained using drawing 7 . Whenever a base station changes a frame, it computes the sum total Nx (=sigmaNt) of the number of slots which can be allocation changed (S0202), and it chooses the migration machine of a transmitting schedule from an allocation list with the frame concerned (S0501). When two or more migration machines are chosen, sum total (when two or more migration machines are chosen) sigmaNr of the demand quality Nr (the number of slots equivalent to the maximum transmission speed) of the selected migration machine is computed (S0502). When the sum total of the difference Nt with this demand quality Nr and Ns is larger than Nx, (S0503:No), The allocation [choosing one migration machine from an allocation list, and using the number of slots (Nxx (Nr/sigma Nr)) which the demand quality of the migration machine concerned to sum total sigmaNr of the whole demand quality is comparatively alike, and matches as the slot which can be allocation changed] (S0505) to the migration machine concerned It gets down and the slot number for Nxx (Nr/sigma Nr) individual is notified by the control channel (S0211). One by one, a migration machine is chosen from an allocation list (S0501), and the slot which can be allocation changed is set up by same count. On the other hand, when Nx is larger than sigmaNt, the slot which is equivalent to demand quality to all the migration machines in an allocation list with (S0503:Yes) and the frame concerned is assigned (S0206), it gets down and a control channel reports the slot number (S0211). the migration machine set up so that the slot near demand quality may transmit to the migration machine near the head of an allocation list with the same frame by the allocation list by the gestalt of this operation of allocation **** if the approach shown with the gestalt 1 of operation is used as shown in drawing 8 -- receiving -- the ratio of demand quality -- responding -- a slot -- allocation ****. Moreover, although set up with the gestalt of this operation by the ratio to the sum of all the demand quality of the migration machine under communication link, the number of slots which can be allocation changed may be set up in the demand quality of each migration machine to the sum of the demand quality of a migration machine which transmits with the same frame by the allocation list. Moreover, another mean value Nz of Nr and Ns is set up, and it is good also as Nt=Nz-Ns.

[0030] According to the slot allocation from a base station, a migration machine performs data transmission in the slot as which each TDMA frame was specified. In drawing 5 , the slot allocation situation in each frame of a specific migration machine is shown. With the gestalt of this operation, a super frame structure is not taken, but each TDMA frame gets down, and a base station notifies the operating slot number to a migration machine in a control channel as

shown in drawing 5 . A base station opts for allocation of the slot which can be allocation changed in each TDMA frame by the above-mentioned approach, and a mobile station performs data transmission by the slot which got down and was specified by the control channel. For this reason, according to timing table sequence, each other's slot will be accommodated to each migration machine in each TDMA frame. Moreover, based on a traffic pattern, i.e., the demand quality, the minimum quality or average transmission, a permission transit delay, etc. from each migration machine, the number of allocation slots and an allocation TDMA frame period can set up accommodation of the slot freely for every migration machine, and it is not fixed per super frame like the conventional example. That is, it does not become allocation spacing depending on a super frame period. As for the migration machine B, in the migration machine A, in drawing 5 , allocation of the slot which can be allocation changed has appeared per 5TDMA frame to the slot which can be allocation changed appearing at intervals of an about 3 TDMA frame. Moreover, accommodation of a slot with other migration machines can also be made dynamic. Although a base station needs to generate the timing table (transmitting authorization table) which gives transmitting authorization here so that two or more migration machines with the same frame may not transmit in the slot currently shared Grouping of the migration machine to which the same slot is not assigned can be carried out, and the approach of specifying the group in whom the migration machine which has the longest queue in origin is contained in the transmission buffer queue length from a migration machine as a transmitting authorization migration machine group in the frame concerned can also be used. According to this approach, since the same slot can be shared with two or more migration machines, improvement in circuit use effectiveness can be aimed at.

[0031] Even if the gestalt 3. base station of operation assigns an adjustable slot based on the original call request of a migration machine, when time amount passes by the amount of the real transmission data from a migration machine, and the migration number of machines which shares a frame, the stagnation amount of data may increase depending on a migration machine. One of the square [this] method of this is explained. Drawing 9 is the processing flow Fig. showing the example of the adjustable slot allocation approach for every frame by the base station in the gestalt 3 of operation of this invention. Drawing 10 is a sequence diagram between the migration machine-base stations which show the sequence of slot reassignment. Hereafter, the slot allocation approach in the gestalt 3 of operation of this invention is explained using drawing 1 and drawing 9 - drawing 10 .

[0032] When the data which there are few slots which can be allocation changed and cannot be transmitted pile up, each mobile station goes up like drawing 10 , and transmits a new allocation demand using a control channel. A base station performs re-calculation of the number of allocation modification slots to the migration machine which received the demand based on the new allocation demand which received by the same processing as the time of a call setup and call clear-down. For example, there is much going-up traffic by which the migration machine is transmitted to a base station in the phase which sent out the call setup demand, and if only the number of slots equivalent to the minimum quality or average transmission is assigned to the migration machine, the migration machine concerned can require reassignment of the slot near demand quality by new allocation demand.

[0033] Drawing 9 explains the slot reassignment processing in a base station. First, a migration machine transmits a slot change request to a base station. Quality information, the number of slots newly assigned now, or the number of the maximum slots by which transmitting authorization was carried out until now is added to this message. If there is this information, a base station can know a former value immediately and will follow it as the guide at the time of being an improvement. A base station computes demand quality (the number of slots equivalent to the maximum transmission speed) from quality information like the time of call origination, and calculates the difference Nz with the current number of allocation slots. The number of slots is changed by the same processing (S0404-S0416) as the gestalt 2 publication of the operation of this Nz to origin.

[0034] In the gestalt of this operation, when it gets down and control data cannot receive normally, a migration machine cannot perform modification of an allocation slot, and it does not

change an allocation slot until it receives the acknowledge signal from an applicable migration machine also in a base station.
[0035] While being able to change the number of slots set up at the time of call origination based on the demand from a migration machine according to this approach, the imitation nature to the traffic fluctuation by sending-out authorization can also improve, and mitigation of a transit delay and improvement in circuit use effectiveness can plan.
[0036] Unlike the gestalt 1 of previous operation thru/or 3, with the gestalt of gestalt 4. book implementation of operation, delivery and a base station explain [considerable information] allocation ****** for an adjustable slot to the traffic fluctuation per unit time amount based on such information from each migration machine. Drawing 11 is the processing flow Fig. showing the adjustable slot allocation approach in the gestalt 4 of operation of this invention. Drawing 12 is a sequence diagram between the migration machine-base stations at the time of performing slot reassignment. Hereafter, the slot allocation approach in the gestalt of this operation is explained using drawing 1 and drawing 11 - drawing 12 .
[0037] Each migration machine measures the queue length of a transmission buffer in a frame unit or convention frame number. The amount of traffic inputted between this frame is added to the transmitting queue length immediately after uphill control signal transmission (x), and the going-up control channel of the following frame reports the transmitting queue length (x) which subtracted the traffic which is equal to the number of slots assigned to the migration machine concerned to a base station as shown in drawing 11 . In a base station, based on the transmitting queue length report from each migration machine, transmitting queue length chooses the migration machine which is over a threshold (Xi), and increases the number of slots of the migration machine which can be allocation changed. Next, queue length chooses the migration machine which is less than the threshold (Xd), and chooses the release schedule slot of the migration machine. The frame (or frame of one more frame after) concerned gets down, and release of a slot and allocation are performed using a control channel. Allocation modification is ended when the acknowledge signal from all migration machines is received. In addition, the ACK/NACK signal from a migration machine may be multiplexed into a user data slot. Moreover, the slot concerned is not changed into a release condition until a release acknowledge signal is received from a migration machine, when releasing a slot. That is, it does not carry out assigning the slot concerned to other migration machines in front of a release condition. This is the same treatment also when managing with the number of slots.
[0038] Next, the increase and decrease of processing of the number of allocation slots in a base station are explained using drawing 11 . A base station receives a report of the transmitting queue length from each migration machine using an uphill control channel (S0701). When the transmitting queue length of each migration machine is over the threshold (Xi), the number Nzp of slots corresponding to the increment (x-Xi) of transmitting queue length is computed (S0703), and it adds to the number of slots of the migration machine which can be allocation changed (S0704). An allocation slot location is notified to the migration machine henceforth by the same processing (S0404-S0415) as the notice of a transmitting slot to the migration machine in each frame shown with the gestalt 2 of operation (S0708). Moreover, when transmitting queue length is below a threshold (Xd), the number Nzm of slots corresponding to the decrement (Xd-x) of transmitting queue die length is computed (S0706), and it subtracts from the number of slots of the migration machine which can be allocation changed. In addition, when the slot number is notified to the migration machine as a slot which can be allocation changed at the time of a call setup, the slot number chooses and (S0707) gets down from a release slot to descending in the assigned slot, and a base station is notified to the migration machine in a control channel (S0708). Moreover, when the approach of reporting the slot used to a migration machine in each frame is adopted, the number of slots to the migration machine which can be allocation changed is changed. In this case, in making it increase and decreasing the processing at the time of a call receptionist, it uses the processing at the time of call clear-down.
[0039] According to this approach, it is possible to make the number of allocation slots fluctuate corresponding to the transmitting queue of a migration machine, and since it follows in footsteps of a transmitting queue by the time delay for which it depended on the transmitting queue report

period from the migration machine and the number of allocation slots can be changed, slot allocation which conformed with the traffic of each migration machine can be performed.
[0040] Gestalt 5. drawing 13 of operation is the sequence diagram showing slot release of the adjustable slot allocation approach in the gestalt 5 of operation of this invention, and drawing 14 is the flow Fig. of slot release processing of the adjustable slot allocation approach. Hereafter, the adjustable slot allocation approach in the gestalt of this operation is explained using drawing 1 and drawing 13 -14.
[0041] the conventional example also explained -- as -- a base station -- setting -- received data -- receiving -- N time continuation -- reception -- being unidentified (NAK) -- if it transmits, an allocation slot is releasable, but a migration machine carries out N time continuous transmission, and an allocation slot will be released also when a base station fails in the data reception by the error of the wireless section etc. by N time continuation. Here, as shown in drawing 13 , a migration machine suspends transmission by the slot which can be allocation changed in case there is no transmit data (accepting it #3 in drawing 13). If it carries out like this, since a base station cannot take the synchronization of the slot concerned, a synchronization serves as a gap, and a different index from the error by CRC can be obtained. For example, the slot to which the base station carried out continuation N time observation of step-out transmits the notice which the next frame of the frame which started step-out [of eye N time] gets down, and releases the slot in the frame concerned which can be allocation changed in a control channel to the migration machine concerned. This approach can be used for all the approaches of setting up the transmitting slot of immobilization to a migration machine beforehand. Moreover, it is applicable to the notice in the case of the approach of reporting a transmitting slot in each frame, in the case of selection of the slot location (number) corresponding to the number of transmitting slots (the gestalten 1-4 of operation the number of slots which can be allocation changed).
[0042] The slot release processing by step-out [in a base station] is explained using drawing 14 . The transmitting queue length report from a migration machine is investigated (S0801), and transmitting queue length (Lq) performs (S0802:No) and the following processings, in being shorter than a threshold (Xp). First, a synchronization memorizes the slot number which caused the gap (S0805), and a base station inspects the condition in the front frame of the slot concerned. In a step-out case, a synchronization counts up the count of a gap (AS) also for the condition in a front frame (S0808). In addition, the conditions and the counts of step-out in a front frame other than the slot concerned are reset (S0806). When the count of step-out is larger than a threshold N, the number of slots which can be allocation changed is decreased by the number of slots concerned (S0809). However, since it is considered aggravation of wireless circuit quality when the transmitting queue length Lq is longer than a threshold Xp and, as for a synchronization, a gap occurs frequently, modification of the number of slots which can be allocation changed is not carried out (S0804). According to this approach, a migration machine does not perform any transmission by the slot concerned, when there is no transmit data (an idle signal is not transmitted, either), but it drops transmitting power. In this way, as for a base station, the slot concerned of the frame concerned is known by that it became step-out and there was no transmission from the migration machine. Therefore, a slot without transmit data is releasable from the allocation slot of the migration machine over a multiple frame. Moreover, if there is no transmit data from a migration machine even when release of the slot which can be allocation changed cannot be carried out, since control information has been mistaken on the way, a base station will release a slot autonomously and will be raised in circuit use effectiveness.
[0043] Gestalt 6. drawing 15 of operation is the sequence diagram showing how to make a slot allocation change auxiliary based on the queue length of the transmission buffer in the example 6 of this invention, and drawing 16 is the slot allocation modification processing flow Fig. Hereafter, the slot allocation modification approach in the gestalt of this operation is explained using drawing 1 and drawing 15 -16.
[0044] A base station receives the transmitting queue length (x) from a migration machine to each frame thru/or every convention frame number (it is 1 time to n frames), as shown in

drawing 15 . With the gestalt 4 of operation, the base station explained the increase and decrease of an approach of the number of slots to a migration machine which can be allocation changed based on the transmitting queue length which received. By the approach of the gestalt 4 this operation, if the relation of two thresholds (Xi, Xd) is Xd<x<Xi, modification of slot allocation will not be performed. However, when fluctuation of the input traffic to the transmitting queue in a migration machine is large (i.e., when [the case where the difference of a peak bit rate and an average bit rate is large, and when burst nature is strong input traffic]), allocation modification will take place frequently. If it does so, a data ****** condition is changed and made the condition that there is no transmit data, and a transmission buffer, and a quality of service may be unable to be protected. Moreover, also when a base station cannot choose a suitable threshold, it will be in the same condition. Furthermore, if modification of the number of allocation modification slots to a migration machine is increased frequently, fluctuation of the number of allocation slots to the load and other migration machines of a base station will become large. With the gestalt of this operation, in order to cope with these situations, a base station measures the count of allocation modification generated between the unit time amount T of each specific migration machine, extends spacing of the threshold for transmitting queue length of the migration machine with which the count of allocation modification became more than N time (Xi, Xd), and decreases allocation modification frequency.
[0045] This allocation modification frequency suitable-ized processing is explained using drawing 16 . A base station checks the timer which it has for every migration (S0901) machine, when a transmitting queue length report is received from a migration machine (S0902). An increment or reduction of the number of slots which can be allocation changed is carried out to the migration machine by the approach which showed whether transmitting queue length would be in thresholds Xd and Xi (Xd<Lq<Xi) when the timer is working with the gestalt 4 of operation when it inspected (S0905) and was out of a threshold, and a count counter value is added (S0906). Moreover, when the timer is not working, a timer is worked (S0903), and a counter value is reset (S0904). Next, when a counter value comes during timer operation more than N, in order to mean that there had been allocation modification of N time within T hours, Thresholds Xd and Xi are changed to Xd=Xd-am and Xi=Xi+an, respectively (S0908). The width of face of the value with which transmitting queue length is permitted can be made to be able to increase (S0908), and the modification frequency of the number of slots itself which can be allocation changed can be decreased as a result (S0909) which resets a receiving timer. According to this approach, since the frequency of the count of allocation modification can be reduced, the inclination to approach peak traffic also to a call with an intense traffic fluctuation period is taken, and data transmission can make a transit delay there be nothing. Furthermore, since the threshold for allocation modification is decided for every call, processing can be mounted, without also performing rationalization of a threshold dynamically and establishing a special case like a setup of the threshold for the high traffic of burst nature.
[0046] Gestalt 7. drawing 17 of operation is a sequence diagram which makes a slot allocation change using the resending demand of ARQ in the gestalt 7 of operation of this invention, and drawing 18 is the flow Fig. showing the slot allocation modification processing. Hereafter, the adjustable slot allocation approach in the gestalt of this operation is explained using drawing 17 and drawing 18 .
[0047] The sequence diagram shown in drawing 17 in case ARQ is carried out between the base station and the mobile station shows signs that the error occurred to the data of No.2, and 3 and 5, among the data (1-6) sent out from the migration machine. If an error is in received data when ARQ is carried out, the data in the frame concerned at least have collected on the transmission buffer in the transmitting side (migration machine) for resending. So, in a base station side, the number of allocation slots can be quickly increased by reducing the threshold for transmitting-side queue length (Xd) based on the number of resending data computed from the data for a resending demand (sequence number etc.).
[0048] Allocation slot modification processing in the base station which is carrying out resending control (for example, ARQ) is explained using drawing 18 . If a base station receives the slot from a migration machine (S1001), CRC (Cyclic Redundancy Check) given to each slot will be

calculated (S1002), and the existence of the error in the slot concerned will be inspected (S1003). However, although the conditions to which CRC is given per slot have indicated in drawing 18 , CRC may be given per data unit within a slot. When an error is detected by the receiving slot, the slot number with which the error was detected is memorized (S1005), and the number of slots with an error (m) is computed (S1006). Here, only a decreases Xi to which m makes the slot of a corresponding mobile station which can be allocation changed increase when larger than a threshold (a0) (S1008). (the gestalten 3 and 4 of operation described) Thus, if Xi is decreased, increment processing of the number of slots which can be allocation changed will progress promptly to the increment in the queue length (x) of the migration machine in the transmitting queue length report from the following migration machine. According to this approach, since the queue length of the transmission buffer for resending is extended, an allocation slot increases to increase of the queue length of a migration machine for a short time, and the transmitting delay by resending can be mitigated.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing showing the example of the TDMA frame structure in this invention.
[Drawing 2] It is the processing flow Fig. of the slot allocation by the base station in the gestalt 1 of operation of this invention.
[Drawing 3] It is a slot allocation modification processing flow Fig. for every frame which a base station performs in the gestalt 1 of operation.
[Drawing 4] In the gestalt 1 of operation, it is a slot allocation modification processing flow Fig. based on a disconnect request.
[Drawing 5] It is drawing showing the example of the slot allocation situation in each frame in this invention.
[Drawing 6] It is the processing flow Fig. of the slot allocation by the base station in the gestalt 2 of operation of this invention.
[Drawing 7] It is a slot allocation modification processing flow Fig. for every frame which a base station performs in the gestalt 2 of operation.
[Drawing 8] It is drawing showing the example of the slot allocation situation in the frame in the gestalt 2 of operation.
[Drawing 9] It is the processing flow Fig. of the slot allocation by the base station in the gestalt 3 of operation of this invention.
[Drawing 10] It is drawing showing the example of the sequence of the slot reassignment in the gestalt 3 of operation.
[Drawing 11] It is the processing flow Fig. of the slot allocation by the base station in the gestalt 4 of operation of this invention.
[Drawing 12] It is drawing showing the example of the sequence of the slot allocation in the gestalt 4 of operation.
[Drawing 13] It is drawing showing the example of the sequence of the adjustable slot allocation in the gestalt 5 of operation of this invention.
[Drawing 14] It is the processing flow Fig. of the slot allocation by the base station in the gestalt 5 of operation of this invention.
[Drawing 15] It is drawing showing the example of the sequence of the adjustable slot allocation in the gestalt 6 of operation of this invention.
[Drawing 16] It is the processing flow Fig. of the slot allocation by the base station in the gestalt 6 of operation of this invention.
[Drawing 17] It is drawing showing the example of the sequence of the adjustable slot allocation in the gestalt 7 of operation of this invention.
[Drawing 18] It is the processing flow Fig. of the slot allocation by the base station in the gestalt 7 of operation of this invention.
[Drawing 19] It is the block diagram of the TDMA frame in the 1st conventional example.
[Drawing 20] It is the processing flow Fig. of the adjustable slot allocation in the 1st conventional example.
[Drawing 21] It is drawing showing the example of the slot release sequence of the adjustable slot system in the 2nd conventional example.

[Description of Notations]
S0103 The number calculation step of slots, S0104 which fulfill the minimum quality The number calculation step of slots which fulfills demand quality, S0105 The number calculation step of adjustable slots, S0108 Fixed-slot secured step, S0110 An adjustable slot secured step, S0112 Adjustable slot secured step, S0301 A cutting reception step, S0304 Adjustable slot reexamination check step, S0307 An adjustable slot reexamination check step, S0502 The number calculation step of slots which fulfills demand quality, S0503 A Nakama adjustable slot check step, S0505 Adjustable slot secured step, S0601 A recurrence call demand reception step, S0603 The number calculation step of slot increments, S0604 An adjustable slot increment secured step, S0808 A step-out number detection step, S1007 Count detection step of an error.

[Translation done.]

引用文献 1

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(71)出願人　000006013
三菱電機株式会社
東京都千代田区丸の内二丁目２番３号

(72)発明者　武　啓二郎
東京都千代田区丸の内二丁目２番３号　三菱電機株式会社内

(72)発明者　伊藤　修治
東京都千代田区丸の内二丁目２番３号　三菱電機株式会社内

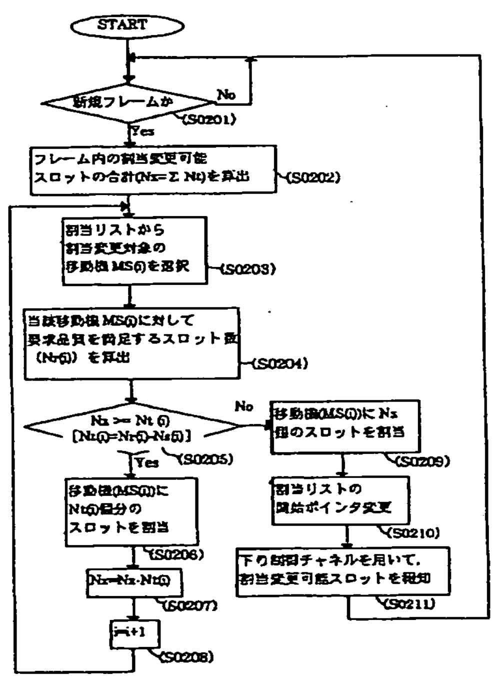
(74)代理人　弁理士　宮田　金雄　（外２名）

(54)【発明の名称】　ＴＤＭＡ可変スロット割当方法

(57)【要約】

【課題】　移動機からの変動トラフィックに対応し、かつ遅延が少なくて対応が速く、回線利用効率がよく、制御チャネルのトラフィックを抑えた可変スロット割当方法を得る。

【解決手段】　基地局と複数の移動機間のシステムにおいて、品質情報を付加して発呼要求を行う移動機と固定・可変スロット確保手段を備え、移動機からの品質情報から最低伝送速度を満足させる第１のスロット数を算出する固定スロット数算出ステップと、品質情報を満足する割当可能な第２のスロット数を算出する可変スロット数算出ステップと、算出されたスロット数を確保する固定スロット確保ステップと、空きスロットがあれば算出されたスロット数に対応するスロットを確保する可変スロット確保ステップとを備えた基地局とで構成される。



【特許請求の範囲】
【請求項１】　基地局と複数の移動機間で時分割ＴＤＭＡチャネルによりデータ伝送するシステムにおいて、
移動機は、基地局へデータ伝送の速度と品質を表す品質情報を付加して発呼要求を行う発呼送信手段を備え、
基地局は、１フレーム中に所定の固定割当スロットと可変割当スロットとを確保する固定・可変スロット確保手段を備え、移動機からの発呼要求中の上記品質情報から最低伝送速度を満足させる第１のスロット数を算出する固定スロット数算出ステップと、
上記移動機からの上記品質情報を満足する割当可能な第２のスロット数を算出する可変スロット数算出ステップと、
上記固定スロット数算出ステップで算出したスロット数を先ず固定割当スロットに確保する固定スロット確保ステップと、
空きスロットがあれば上記可変スロット数算出ステップで算出したスロット数に対応する可変スロットを確保する可変スロット確保ステップとを備えて、上記移動機に確保結果を通知し、対応する移動機からの上記固定・可変の両スロットのデータを処理するようにしたことを特徴とするＴＤＭＡ可変スロット割当方法。
【請求項２】　基地局は、移動機からの切断要求があると、対応する固定割当スロットを解放して空きスロットにするステップと、
残存移動機の品質情報で要求される可変スロット数の和が現用の可変スロット数より多い場合は、上記切断要求があった移動機の可変スロットを再割当するステップとを付加したことを特徴とする請求項１記載のＴＤＭＡ可変スロット割当方法。
【請求項３】　基地局は、発呼要求があった移動機を必要な品質情報と対応して記憶する割当リストを備えて、各フレームでの可変スロットを確保する可変スロット確保ステップにおいて、上記割当リストを参照して対応する移動機の可変スロットを決めるようにしたことを特徴とする請求項１記載のＴＤＭＡ可変スロット割当方法。
【請求項４】　基地局は、可変スロット数算出ステップに代えて、最低伝送速度を満足させる第１のスロット数と品質情報を満足する第２のスロット数との中間品質対応の第３のスロット数を算出する中間可変スロット数算出ステップを備え、
可変スロット確保ステップは、可変スロットに空きスロットがあれば上記中間可変スロット数算出ステップで算出した第３のスロット数に対応する可変スロットを確保するようにしたことを特徴とする請求項１記載のＴＤＭＡ可変スロット割当方法。
【請求項５】　移動機は、自身の送信データ量が所定の値を超えると、基地局に対してスロット追加要求を送信するようにし、
基地局は、上記移動機からのスロット追加要求を受信すると、該情報を基に可変スロット数算出ステップで再計算して可変スロットを確保し直すようにしたことを特徴とする請求項１記載のＴＤＭＡ可変スロット割当方法。
【請求項６】　移動機は、スロット追加要求に際して現使用可変スロット数の情報を送信し、基地局は、対応する移動機からの上記現使用可変スロット数情報を基に可変スロット数算出ステップで再計算して可変スロットを確保し直すようにしたことを特徴とする請求項５記載のＴＤＭＡ可変スロット割当方法。
【請求項７】　移動機は、現在の必要送信データ量を送信する手段を備え、
基地局は、上記各移動機からの現在の必要送信データ量を監視して第１の閾値を超えると、可変スロット数確保ステップでは閾値を超えた上記移動機に対する可変スロット数を増加させ、第２の閾値を下回ると、上記移動機に対する可変スロット数を減少させるようにしたことを特徴とする請求項１記載のＴＤＭＡ可変スロット割当方法。
【請求項８】　基地局は、移動機に対する可変スロット数を減少させる場合は、上記移動機からの解放確認信号を受信するまでは上記可変スロット数を確保しておくようにしたことを特徴とする請求項７記載のＴＤＭＡ可変スロット割当方法。
【請求項９】　移動機は、送信データがない場合は可変スロットでの送信を停止するようにし、
基地局は、移動機からの送信データが乗るスロットの同期を検出する手段を備え、上記同期が所定の連続回数以上外れることを検出するステップを備えて、
上記連続同期外れを検出すると対応する移動機に対する可変スロットを解放するようにしたことを特徴とする請求項１記載のＴＤＭＡ可変スロット割当方法。
【請求項１０】　基地局は、所定の時間内における特定移動機に対する可変スロット数割当数の増加と減少指示回数を計測するステップを設けて、増加と減少指示回数が設定値以上になると、上記移動機の必要送信データ量を監視する第１と第２の閾値を変更するようにしたことを特徴とする請求項７記載のＴＤＭＡ可変スロット割当方法。
【請求項１１】　基地局は、移動機からの送信データを受信してスロット対応に誤りを検出する手段を備え、所定の数以上の上記誤りを検出すると、可変スロット確保ステップで対応移動機に確保する可変スロット数を増加するようにしたことを特徴とする請求項１または請求項７記載のＴＤＭＡ可変スロット割当方法。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、ＴＤＭＡ（Ｔｉｍｅ　Ｄｉｖｉｓｉｏｎ　Ｍｕｌｔｉｐｌｅ　Ａｃｃｅｓｓ）方式を用いてＡＴＭセルを伝送する無線通信システムにおいて、各基地局での移動機に対するＴＤＭＡスロ

ットの可変割当方法に関する。

【0002】

【従来の技術】ＴＤＭＡ方式を用いた無線通信システムにおける、各移動機に対するＴＤＭＡスロットの割り当て方法には、固定割当方式と可変割当方式がある。従来のＴＤＭＡ方式を用いたディジタル携帯電話／自動車電話システムやＰＨＳ（Ｐｅｒｓｏｎａｌ　Ｈａｎｄｙｐｈｏｎｅ　Ｓｙｓｔｅｍ）に代表されるディジタルコードレス電話では、各移動機に対して一定数の特定のＴＤＭＡスロットを固定的に割り当てる上述の固定割当方法がとられている。一方で、次世代の携帯電話／自動車電話システムにおいては、Ｂ－ＩＳＤＮに代表される広帯域通信ネットワークとの整合性から、ＡＴＭセルやパケットを伝送する必要が生じており、その結果、動的に変化するトラフィックを伝送するために、割当スロットの伝送品質だけではなく、移動機毎の変化するトラフィックに対応させて、移動機に対する上述の割当スロットを動的に変更する可変スロット割当が必要となる。

【0003】従来の可変スロット割当方法では、コネクション型の呼に対しては、１ＴＤＭＡフレーム内の特定スロットを各ＴＤＭＡフレーム内に移動機からの要求に基づいて固定的／もしくは特定フレーム数毎に割り当て、コネクションレス型の呼に対しては、１ＴＤＭＡフレーム毎にコネクション型の呼に割り当てたスロット以降のスロットを割り当てる方式がある。可変スロット割当方法は、例えば、特開平９－１８４３５に示されている。以下に、従来の方法について、図１９、２０を参照しながら説明する。

【0004】図１９は第１の従来例におけるＴＤＭＡフレーム構成を示す図である。１フレームは固定長であり、複数のスロット（Ｘ個のスロット）から構成されている。フレームの前半は基地局から移動機に対する下り回線（Ｄｏｗｎ　Ｌｉｎｋ）であり、後半は移動機から基地局に対する上り回線（Ｕｐ　Ｌｉｎｋ）である。上述の下り回線の前半は基地局から各移動機に対する制御情報を伝送するために用いられる下り制御スロット群であり、Ｓｃ個のスロットで構成される。下り回線の後半は基地局から移動機に対するＡＴＭセル伝送要の下りデータスロット群であり、Ｓｕ個のスロットで構成される。また、上述のフレームの後半は移動機から基地局に対する上り回線であり、当該上り回線の先頭は、移動機から基地局に対する制御データを伝送するために用いられるランダムアクセス用スロット群であり、Ｔｒ個の固定長のスロットで構成される。またランダムアクセス用スロット群に続くスロット群は、アベーラブルビットレート（ＡＢＲ）用であり、Ｔａ個のスロットにより構成される。ＡＢＲ用スロット群に続くスロット群が、バリアブルビットレート（ＶＢＲ）用であり、Ｔｖ個のスロットにより構成される。上述のフレームの最後には固定レート（ＣＢＲ）用のスロット群があり、Ｔｃ個のスロットにより構成される。フレーム内の全スロットＸは一定であり、Ｓｃ、Ｓｕ、Ｔｒ、Ｔａ、Ｔｖ、Ｔｃの合計は常にＸとなるが、各スロット群の数Ｓｃ、Ｓｕ、Ｔｒ、Ｔａ、Ｔｖ、Ｔｃは、トラフィックに応じて各フレームで基地局の制御部により変更される。さらに、複数のフレームから構成されるスーパーフレームも形成される。図１９では４ＴＤＭＡフレームにて１スーパーフレームを形成した状態を示している。

【0005】図２０は、この第１の従来例における可変スロット割当処理フロー図である。図２０を用いてスロット割当動作を説明する。上述の基地局制御部スロット割当部では、ＳｃとＳｕの値は基地局内の送信データから算出し、Ｔｃは移動機からの呼受け付け時に固定的に割り出し、Ｔｒは固定値で設定される。また、Ｔｖの値は呼受け付け時のＵＰＣ（Ｕｓｅｒ　Ｐａｒａｍｅｔｅｒ　Ｃｏｎｔｏｒｌ）値を用いて１フレームではなくてスーパーフレーム内で一定レート、理想的にはピークレートが割り当てられる。但し、各フレームにおいては、各ＶＢＲ呼毎に固定的にスロットが割り当てられるのではなく、最初に各ＶＢＲ呼間でスロットの割り当てが融通され、以降のスーパーフレームでは固定される。図１９において、移動機Ａと移動機ＢはそれぞれのＴＤＭＡフレームにおいてはお互いにスロット割当が融通されている状態、ならびにスーパーフレーム単位ではスロットが固定されている状態を示している。すなわち、スーパーフレーム内の各ＴＤＭＡフレーム単位で見ると移動機Ａと移動機Ｂは互いに同一スロットが割り当てられないように、ＵＰＣで値で規定された品質を保証するように各ＴＤＭＡフレームにおいてスロットが可変に割当てられている。一方、スーパーフレーム単位に移動機Ａ、移動機Ｂに対するスロット割当位置は固定であり、スーパーフレーム単位で繰り返し同一スロットが割り当てられる。最後に、ＴａはＸからＳｃ、Ｓｕ、Ｔｒ、Ｔｖ、Ｔｃの合計を引いた値が設定される。以上の通りフレーム単位に設定されたＳｃ、Ｓｕ、Ｔｒ、Ｔａ、Ｔｖ、Ｔｃに対応したスロット位置を、各フレームないし数フレームに一度更新して各移動機に報知することにより、可変スロット割り当てを実現している。なお、上述のＡＢＲ呼については、各フレームの上り制御チャネルで要求した移動機にフレーム単位でＴａ個のスロットが割り当てられる。

【0006】また、従来の可変スロット割当では、無線区間の誤りを考慮した方法も考慮されており、例えば、１９９６年電子情報通信学会通信ソサイエティ大会Ｂ－３１１「ワイヤレスＡＴＭに適した集中制御型動的帯域割り当て方式の検討」に示されている。以下に、第２の従来の方法について、図２１を参照しながら説明する。

【0007】図２１はＴＤＭＡ方式を用いた無線ＡＴＭ通信システムにおける、第２の従来例での可変スロット割当方式によるスロット解放に関するシーケンス図であ

る。このシーケンスを用いた無線ＡＴＭ通信システムは、基地局と１つ以上の移動機との間でＴＤＭＡ方式を用いた無線アクセス方式によりＡＴＭセルを伝送可能なシステムであり、基地局と移動機との間には、移動機毎に個別の制御回線、すなわち上り制御スロット及び下り制御スロットが設けられており、各移動機に対して基地局は移動機からの要求に応じて１ＴＤＭＡフレーム内で複数のデータ伝送用スロットを割り当てる。各移動機においては送信キュー長を基地局に送信し、基地局は前記移動機の送信キュー長から移動機に対して割り当てたスロット以上のデータが移動機の送信キューにあると判断した場合には、制御回線を用いて新たなスロットの割当を基地局に要求し、基地局はその要求に応じたスロットを、他の移動機に未割当のスロットから選択し、要求元移動機に制御回線で前記スロットの割当結果を通知する。一方、移動機からのデータ送信がＮフレーム連続でない場合には、送信データがなかった移動機及び基地局は自立的にデータ送信がなされなかったスロットを解放する方法が提案されている。

【０００８】

【発明が解決しようとする課題】従来の可変スロット割当方式では、スーパーフレーム周期内の定められたスロット位置でデータの送信を行なう為、トラフィック変動に即座に対応できず伝送遅延が増加するという課題がある。また、送出スロット位置が完全に固定されているか、もしくは動的に変更する場合には制御チャネルで随時（Ｎ（≧１）フレーム毎）実施する為に、制御チャネルに誤りが発生した場合にはスロット割り当てが変更できず回線利用効率が悪化するという課題もある。更に、動的にスロットを割り当てる場合にスロット位置の指定、すなわちスロット番号を変更時に通知する為、制御チャネルのトラフィックが増大するという課題もある。また逆に、制御チャネルが誤りの有無に関わらずｋ回連続で割り当て要求が無い場合には解放する為、制御情報が誤った場合には移動機は送信データがあってもスロットを解放してしまうという課題もある。また、更に、ＡＲＱ等の再送制御が用いられている場合には、基地局における受信データに誤りがあれば必ず再送が起こり送信バッファのキュー長が伸びる。しかし、実際の割り当てスロットの増加要求までにはタイムラグがあるため、伝送遅延が発生するという課題もあった。

【０００９】本発明は、上記の課題を解消するためになされたもので、移動機からの変動トラフィックに対応し、かつ遅延が少なくて対応が速く、回線利用効率がよく、制御チャネルのトラフィックを抑えた可変スロット割当方法を得ることを目的とする。

【００１０】

【課題を解決するための手段】この発明に係るＴＤＭＡ可変スロット割当方法は、基地局と複数の移動機間で時分割ＴＤＭＡチャネルによりデータ伝送するシステムにおいて、移動機は、基地局へデータ伝送の速度と品質を表す品質情報を付加して発呼要求を行う発呼送信手段を備え、基地局は、１フレーム中に所定の固定割当スロットと可変割当スロットとを確保する固定・可変スロット確保手段を備え、移動機からの発呼要求中の品質情報から最低伝送速度を満足させる第１のスロット数を算出する固定スロット数算出ステップと、移動機からの品質情報を満足する割当可能な第２のスロット数を算出する可変スロット数算出ステップと、固定スロット数算出ステップで算出したスロット数を先ず固定割当スロットに確保する固定スロット確保ステップと、可変スロットに空きスロットがあれば可変スロット数算出ステップで算出したスロット数に対応する可変スロットを確保する可変スロット確保ステップとを備え、移動機に確保結果を通知し、対応する移動機からの上記固定・可変の両スロットのデータを処理するようにした。

【００１１】また更に、基地局は、移動機からの切断要求があると、対応する固定割当スロットを解放して空きスロットにするステップと、残存移動機の品質情報で要求される可変スロット数の和が現用の可変スロット数より多い場合は、切断要求があった移動機の可変スロットを再割当するステップとを付加した。

【００１２】また更に、基地局は、発呼要求があった移動機を必要な品質情報と対応して記憶する割当リストを備えて、フレームの可変スロットを確保する可変スロット確保ステップにおいて割当リストを参照して対応する移動機の可変スロットを決めるようにした。

【００１３】また更に、基地局は、可変スロット数算出ステップに代えて、最低伝送速度を満足させる第１のスロット数と品質情報を満足する第２のスロット数との中間品質対応の第３のスロット数を算出する中間可変スロット数算出ステップを備え、可変スロット確保ステップは、可変スロットに空きスロットがあれば中間可変スロット数算出ステップで算出した第３のスロット数に対応する可変スロットを確保するようにした。

【００１４】また更に、移動機は、自身の送信データ量が所定の値を超えると基地局に対してスロット追加要求を送信するようにし、基地局は、移動機からのスロット追加要求を受信すると、その情報を基に可変スロット数算出ステップで再計算して可変スロットを確保し直すようにした。

【００１５】また更に、移動機は、スロット追加要求に際して現使用可変スロット数の情報を送信し、基地局は、対応する移動機からの上記現使用可変スロット数情報を基に可変スロット数算出ステップで再計算して可変スロットを確保し直すようにした。

【００１６】また更に、移動機は、現在の必要送信データ量を送信する手段を備え、基地局は、各移動機からの現在の必要送信データ量を監視して第１の閾値を超えると、可変スロット数確保ステップでは閾値を超えた移動

機に対する可変スロット数を増加させ、第２の閾値を下回ると、移動機に対する可変スロット数を減少させるようにした。

【００１７】また更に、基地局は、移動機に対する可変スロット数を減少させる場合は、移動機からの解放確認信号を受信するまでは可変スロット数を確保しておくようにした。

【００１８】また更に、移動機は、送信データがない場合は可変スロットでの送信を停止するようにし、基地局は、移動機からの送信データが送信されるスロットの同期を検出する手段を備え、この同期が所定の連続回数以上外れることを検出するステップを備えて、連続同期外れを検出すると対応する移動機に対する可変スロットを解放するようにした。

【００１９】また更に、基地局は、所定の時間内における特定移動機に対する可変スロット数割当の増加と減少指示回数を計測するステップを設けて、増加と減少指示回数が設定値以上になると、移動機の必要送信データ量を監視する第１と第２の閾値を変更するようにした。

【００２０】また更に、基地局は、移動機からの送信データを受信してスロット対応に誤りを検出する手段を備え、所定の数以上のこれら誤りを検出すると、可変スロット確保ステップで対応移動機に確保する可変スロット数を増加するようにした。

【００２１】

【発明の実施の形態】

実施の形態１．本発明では、移動機からの伝送要求を分析して、伝送のための最低品質を伝送するための固定スロットと、望ましい伝送品質を伝送するために加算される可変スロットに分け、固定スロットはいかなる状況でも伝送中は削減せず、可変スロットは各移動機からの要求の数、品質情報などに応じて増減配分をする。図１は本発明におけるＴＤＭＡフレーム構成の例を示す図であり、図２は基地局における移動機から発呼時の当該移動機に対するスロット割当の処理フローを示す図であり、図３は基地局における各フレーム毎のスロット割当変更に関する処理フローを示す図であり、図４は基地局における移動機からの切断要求受信時のスロット割当変更の処理フローを示す図であり、図５は各フレームにおけるスロット割当状況の例を示す図である。以下、図１～図５を用いて本発明の基地局におけるスロット割当方法の例を説明する。図１に示す通り、ＴＤＭＡフレームは上下制御チャネル用スロットならびにユーザデータ用スロットから構成される。なお、ユーザデータスロットは、上り／下りの区分はなく、基地局において上り／下りに動的に割当てられる。また、固定スロットについては割当後の変更を呼が終了するまで実施しないことは、以後の各実施の形態について共通である。

【００２２】次に、図２を用いて基地局における移動機からの発呼時のスロット割当方法について説明する。移動機は上り制御チャネルを用いて、基地局に対して発呼要求を行なう。その際に移動機は発呼要求メッセージに移動機が要求する品質情報を付加して送信する。品質情報とは、最低必要な伝送速度、平均伝送速度、最大伝送速度、許容遅延時間、廃棄率などを示す情報である。基地局は移動機からの発呼要求を受信すると（ステップＳ０１０１、以後ステップの呼称を省略する）その発呼メッセージ内の品質情報をみて（Ｓ０１０２）、ただちに移動機が通信に最低必要なスロット数（Ｓ０１０３）と１フレーム内で最大必要なスロット数を算出する（Ｓ０１０４）。

【００２３】算出した最低必要なスロット数（Ｎｓ）を１フレーム内の空き分から割当可能か判断し（Ｓ０１０６）、割当可能な場合には固定割当スロットとして当該移動機に割当てる（Ｓ０１０８）。割当が不可能な場合には、その移動機からの発呼は呼損となる（Ｓ０１０７）。また、当該発呼メッセージ内の品質情報の最大伝送速度から、移動機が１フレームで使用する最大スロット数（Ｎｒ）を算出する（Ｓ０１０４）。その最大スロット数が可変スロットの空きスロットによって割当可能な場合には（Ｓ０１０９）、その移動機に対して割当変更可能スロットとしてＮｒ－Ｎｓ個のスロットを割当てる。また、可変スロットの空きでは（Ｎｒ－Ｎｓ）個のスロットが割当られない場合には（Ｓ０１０９：Ｎｏ）、空いている可変スロットすべてがその移動機の割当変更可能スロットとして割当られる（Ｓ０１１０）。以上のように算出されたスロット数に対応したスロット番号が設定され下り制御チャネルを用いて発呼要求を出した移動機に対して固定割当スロットならびに割当変更可能スロットのスロット番号が通知される（Ｓ０１１５）。なお、各移動機に対しては固定割当スロットのスロット番号のみを通知し、以下に述べる方法で割当変更可能スロットを各フレームで各移動機で順次使用することとも可能である。

【００２４】図３を用いて各フレームにおいて基地局が発呼要求のあった移動機に対して、要求品質と最低品質の差をまかなう可変割当スロットの利用許可を行なう方法を説明する。基地局は各フレームにおいて割当変更可能スロットの合計（ΣＮｔ）を算出する（Ｓ０２０２）。次にあらかじめ各移動機からの発呼メッセージの品質情報に基づき作成されたタイミングテーブルから選んで、あるフレームにおいて最大速度でのデータ伝送を行なわなくてはならない移動機をまず選択する（Ｓ０２０３）。そして選択された移動機の最大伝送速度に匹敵するスロット数（Ｎｒ）を算出する（Ｓ０２０４）。このＮｒと最低伝送速度に匹敵するスロットＮｓとの差が通信中の全移動機の割当変更可能スロット数の合計Ｎｘよりも小さければ、その移動機にＮｒ個分のスロットを割当て（Ｓ０２０６）、割当リストの次の移動機に対しても同様の処理を行う（Ｓ０２０８）。一方、ＮｒがＮ

ｘよりも大きければ、Ｎｘを当該移動機に割当変更可能スロットとして割り当てる（Ｓ０２０９）。ここで、割当リストは呼受け付け時に作成され、品質情報に従って、各移動機に対する割当変更可能スロットを割り当てる周期毎に各移動機が登録されている。このため、図５に示したように移動機は通常、固定割当スロットのみで送信し、割当リストに登録されたフレームにおいて割当変更可能スロットの利用が可能となる。つまり移動機毎に割当てられた可変スロットの数のみがフレームが移ると変動することがある。また、効率は悪くなるが、割当リストを持たないで、可変スロットの割当に先立って各移動機の要求品質を調べるようにしてもよい。

【００２５】次に、図４を用いて基地局における移動機からの呼切断時のスロット解放方法について説明する。基地局は上り制御チャネルでの移動機からの切断要求を受信した場合には（Ｓ０３０１）、その移動機を含め通信中の移動機の要求品質（最大伝送速度に相当する）スロット数の合計Ｎｙ（＝ΣＮｒ（ｉ））を算出する（Ｓ０３０２）。切断要求を送出した移動機に対して固定割当スロットとして割り当てたスロットＮｓを解放したのち（Ｓ０３０３）、割当変更可能スロット数の合計Ｎｘ（＝ΣＮｔ）と要求品質スロット数の合計Ｎｙ（ともにその移動機のスロット数も含む）が一致した場合には（Ｓ０３０４：Ｙｅｓ）、その移動機を含めすべての移動機には要求品質通りのスロットが割当てられているとみなし、当該移動機の割当変更可能スロットの全てを解放する（Ｓ０３０５）。一方、ＮｙとＮｘが一致しない場合には（Ｓ０３０４：Ｎｏ）、つまり要求品質からのスロット数と実際に許可している可変スロットの数とが一致していないので、どれかの移動機には要求品質通りのスロットが割当てられていない。従って、当該移動機以外の移動機に対して要求品質を満たすスロット数、要求品質を満たすスロット数が確保できない。そこで、要求品質を満たすスロット数を空きスロットから確保できる場合には（Ｓ０３０７：Ｙｅｓ）、要求品質に匹敵するスロットを割当変更可能スロットとし（Ｓ０３０９）、空きスロットが要求品質に匹敵するスロット数に足りない場合でも（Ｓ０３０７：Ｎｏ）、可変の空きスロットのすべてを割当変更可能スロットとする（Ｓ０３０８）。この場合には、当該移動機に割り当てられていたスロットの全てもしくは一部は解放されない。当該移動機に対して割当られたスロットに対する処理が終了した段階で、当該移動機を割当リストから削除し（Ｓ０３１０）、次フレームの下り制御チャネルにより、当該移動機に対して切断受け付けを送信する（Ｓ０３１１）。

【００２６】ここで、移動機が正常に下り制御チャネルを受信できず、送信許可の確認ができない場合には、固定割当スロットのみを用いてデータ伝送を行なうこととなる。また、本実施の形態の図１または図５において、固定割当スロット及び割当変更可能スロットの割当スロ

ット内の相対位置についてはいかなるパターンでもよい。また、固定割当スロット数は最低品質を保証するスロット数であるが、ＡＲＱなどの再送制御を実施する場合や、無線回線品質が劣悪であって、制御チャネルの伝送品質が悪い場合には最低品質を保証するスロット数以上のスロットを固定割当としてもよい。上述した実施の形態１の方法によれば、各移動機に対して各フレームで送信許可のみを与えるだけで割当て変更ができるうえ、トラフィックに応じて送出許可回数を変化させることでトラフィック変動に柔軟に対応でき、伝送遅延を軽減できる。

【００２７】実施の形態２．実施の形態１では、可変スロットの割当を割当リストに記載の移動機を順に選んで先頭から割り当てる方法であった。ここでは要求のあった移動機になるべく公平に可変スロットを割り当てる方法を説明する。図６は本発明の可変スロット割当方法の実施の形態２における処理フロー図であり、基地局における移動機から発呼時の移動機に対するスロット割当の処理を示している。図７は、基地局における各フレーム毎のスロット割当変更に関する処理フロー図を、図８は、あるフレームにおけるスロット割当状況の例を示す図である。以下、図１、及び図５～図８を用いて本実施の形態における基地局によるスロット割当方法を説明する。

【００２８】まず、基地局における発呼時の移動機に対するスロット割当処理は、以下の図６に示す通りとなる。基地局は上り制御チャネルにより、移動機からの発呼受け付けを受信した場合には（Ｓ０１０１）、実施の形態１で示した処理により発呼メッセージ内の要求品質の分析（Ｓ０１０２）から最低品質を満足するスロット数Ｎｓならびに最大伝送速度に相当するスロット数Ｎｒを算出し（Ｓ０１０３、Ｓ０１０４）、ＮｒとＮｓの差分Ｎｔを計算する（Ｓ０１０５）。Ｎｓが空きスロットから割当て不可能な場合には呼損となる（Ｓ０１０７）。次に、割当変更可能スロット数は、当該移動機の最大伝送速度に相当するスロット数Ｎｒと固定割当スロット数Ｎｓとの差分Ｎｔと、当該移動機の品質情報から得られる平均伝送速度に相当するスロット数と固定割当スロット数Ｎｓとの差分Ｎｖ、ならびに通信中のその他の移動機のＮｔとＮｖの差分の合計Ｓ（＝ΣＮｔ－Ｎｖ）を計算し（Ｓ０４０２）、このＳと、空きスロットＮｏとの関係により設定する。他の移動機のＮｔとＮｖの差分の合計Ｓよりも当該移動機のＮｔとＮｖの差分が小さい場合は（Ｓ０４０３：Ｙｅｓ）、当該移動機の割当変更可能スロット数は平均伝送速度に相当するスロット数Ｎｖ（但し、Ｎｓ＋Ｎｖで平均伝送速度に相当する）を割り当てる（Ｓ０４０４）。逆に、ＳよりもＮｔ－Ｎｖの差分が大きい場合には（Ｓ０４０３：Ｎｏ）、当該移動機にＮｔ－Ｓ個のスロットを割当変更可能スロットとして割り当てる（Ｓ０４１０）。但し、上記の双

方の割当数が空きスロットＮｏよりも大きい場合にはＮｏ＋ＳがＮｖもしくはＮｔよりも大きければＮｏ（Ｎｖの場合）（Ｓ０４０８）、もしくはＮｏ＋Ｓ（Ｎｔ－Ｓの場合）を割り当てるが（Ｓ０４１３）、ＮｖがＳ＋Ｎｏよりも大きい場合は呼損となる（Ｓ０１０７）。以上により、移動機毎の割当スロット数が設定される。ここで、固定割当スロットは変更されないので、各フレームでのスロット位置を指定する（Ｓ０４１６）。割当変更可能スロットについては、スロット番号を指定し、移動機毎に割当変更可能スロット間で同一フレームにて同一スロットを使用しないように割当リストを作成することも可能であり、図６の方法でスロット数のみを設定し、以下の方法で各フレーム毎に送出スロット番号を決定することも可能である。

【００２９】次に、図７を用いて各フレームにおける移動機に対する可変スロット割当方法について説明する。基地局はフレームが変わる毎に割当変更可能スロット数の合計Ｎｘ（＝ΣＮｔ）を算出し（Ｓ０２０２）、当該フレームで送信予定の移動機を割当リストから選択する（Ｓ０５０１）。複数の移動機が選択されている場合は選択された移動機の要求品質Ｎｒ（最大伝送速度に相当するスロット数）の合計（複数の移動機が選択されている場合）ΣＮｒを算出する（Ｓ０５０２）。この要求品質ＮｒとＮｓとの差Ｎｔの合計がＮｘよりも大きい場合には（Ｓ０５０３：Ｎｏ）、割当リストから１つの移動機を選択し、全体の要求品質の合計ΣＮｒに対する当該移動機の要求品質の割合に匹敵するスロット数（Ｎｘ×（Ｎｒ／ΣＮｒ））を割当変更可能スロットとして当該移動機に割当て（Ｓ０５０５）、下り制御チャネルでＮｘ×（Ｎｒ／ΣＮｒ）個分のスロット番号を通知する（Ｓ０２１１）。順次、割当リストから移動機を選択し（Ｓ０５０１）、同様の計算により、割当変更可能スロットを設定する。一方、ＮｘがΣＮｔよりも大きい場合には（Ｓ０５０３：Ｙｅｓ）、当該フレームで割当リスト内のすべての移動機に対して要求品質に相当するスロットを割り当て（Ｓ０２０６）、下り制御チャネルでスロット番号を報知する（Ｓ０２１１）。図８に示すように実施の形態１で示した方法を用いれば、割当リストの先頭に近い移動機には要求品質に近いスロットが割当られるが、本実施の形態では割当リストで同一フレームで送信するように設定されている移動機に対しては、要求品質の比に応じてスロットが割当られる。また、本実施の形態では通信中の移動機のすべての要求品質の和に対する比で設定したが、割当リストで同一フレームで送信する移動機の要求品質の和に対する各移動機の要求品質で割当変更可能スロット数を設定してもよい。また、別のＮｒとＮｓの中間値Ｎｚを設定してＮｔ＝Ｎｚ－Ｎｓとしてもよい。

【００３０】基地局からのスロット割当に従い移動機は各ＴＤＭＡフレームの指定されたスロットにおいてデータ送信を行う。図５において、特定の移動機の各フレームにおけるスロット割当状況が示されている。図５に示す通り本実施の形態ではスーパーフレーム構成を取らず、各ＴＤＭＡフレームの下り制御チャネルにおいて、基地局は移動機に対して使用スロット番号を通知する。上述の方法で基地局は各ＴＤＭＡフレームにおいて割当変更可能スロットの割当を決定し、移動局は下り制御チャネルで指定されたスロットでデータ伝送を行う。このため、タイミングテーブル順序に従い各ＴＤＭＡフレームにおいて各移動機に対してスロットを融通し合うことになる。また、そのスロットの融通は各移動機からのトラフィックパターン、すなわち要求品質、最低品質もしくは平均伝送速度、ならびに許容伝送遅延などに基づき、割当スロット数や割当ＴＤＭＡフレーム周期が各移動機毎に自由に設定することができ、従来例のようにスーパーフレーム単位に固定とはならない。すなわち、スーパーフレーム周期に依存した割当間隔とはならない。図５では移動機Ａは割当変更可能スロットがほぼ３ＴＤＭＡフレーム間隔で現れるのに対して、移動機Ｂは５ＴＤＭＡフレーム単位に割当変更可能スロットの割当が出現している。また、他の移動機とのスロットの融通も動的にできる。ここで、基地局は共用しているスロットにおいて同一フレームで複数の移動機が送信することがないように、送信許可を与えるタイミングテーブル（送信許可テーブル）を生成する必要があるが、同一スロットを割り当てられていない移動機をグループ化し、移動機からの送信バッファキュー長を元に一番長いキューを持つ移動機が含まれるグループを当該フレームでの送信許可移動機群として指定していく方法を用いることもできる。この方法によれば、同一スロットを複数の移動機で共用できるので回線利用効率の向上を図ることができる。

【００３１】実施の形態３．基地局が移動機からの当初の発呼要求に基いて可変スロットを割当てても、移動機からの実伝送データの量や、フレームを共有する移動機数によって時間が経過すると移動機によっては滞留データ量が多くなることがある。この是正方法の１つを説明する。図９は本発明の実施の形態３における基地局による各フレーム毎の可変スロット割当方法の例を示す処理フロー図である。図１０はスロット再割当のシーケンスを示す移動機－基地局間のシーケンス図である。以下、図１、及び図９～図１０を用いて本発明の実施の形態３におけるスロット割当方法を説明する。

【００３２】各移動局は、割当変更可能スロットが少なくて送信出来ないデータが滞留した場合には、図１０のように上り制御チャネルを用いて新規割当要求を送信する。基地局は、受信した新規割当要求に基づき、呼設定時や呼切断時と同一の処理により、要求を受けた移動機に対する割当変更スロット数の再算出を行う。例えば、その移動機が呼設定要求を送出した段階では、基地局に

送信される上りトラフィックが多くて、その移動機に最低品質のみ、または平均伝送速度に相当するスロット数のみが割り当てられていれば、当該移動機は新規の割当要求により要求品質に近いスロットの再割当を要求することができる。

【００３３】図9により基地局におけるスロット再割当処理を説明する。まず、移動機は基地局に対して、スロット変更要求を送信する。このメッセージには品質情報と新たに現在割り当てられているスロット数ないしこれまでに送信許可された最大スロット数を付加する。この情報があれば基地局は直ちに以前の値を知ることができ、改善の際の目安にできる。基地局は発呼時と同様に品質情報から要求品質（最大伝送速度に相当するスロット数）を算出し、現在の割当スロット数との差分Ｎｚを計算する。このＮｚを元に実施の形態２記載と同様の処理（Ｓ０４０４～Ｓ０４１６）にてスロット数の変更を実施する。

【００３４】本実施の形態においても、下り制御データが正常に受信できない場合には移動機は割当スロットの変更はできず、基地局においても該当移動機からの確認信号を受信するまでは割当スロットの変更を実施しない。

【００３５】この方法によれば、発呼時に設定されたスロット数を移動機からの要求に基づいて変更できると共に、送出許可によるトラフィック変動に対する追随性も向上でき、伝送遅延の軽減、回線利用効率の向上が図ることができる。

【００３６】実施の形態４．本実施の形態では先の実施の形態１ないし３と異なり、各移動機から単位時間当りのトラフィック変動に相当の情報を送り、基地局ではこれらの情報を基に可変スロットを割当る方法を説明する。図１１は本発明の実施の形態４における可変スロット割当方法を示す処理フロー図である。図１２はスロット再割当を行う際の移動機－基地局間のシーケンス図である。以下、図１、及び図１１～図１２を用いて本実施の形態におけるスロット割当方法を説明する。

【００３７】各移動機は送信バッファのキュー長をフレーム単位、もしくは規定フレーム数単位に計測する。図１１に示す通り、上り制御信号送信直後の送信キュー長（ｘ）に、このフレームの間に入力したトラフィック量を加算し、当該移動機に割当てられたスロット数に匹敵するトラフィックを減算した送信キュー長（ｘ）を次のフレームの上り制御チャネルで基地局に報告する。基地局では、各移動機からの送信キュー長報告に基づき、送信キュー長が閾値（Ｘｉ）を超過している移動機を選択し、その移動機の割当変更可能スロット数を増大させる。次に、キュー長が閾値（Ｘｄ）を下回っている移動機を選択し、その移動機の解放予定スロットを選択する。当該フレーム（もしくはもう１フレーム後のフレーム）の下り制御チャネルを用いて、スロットの解放、割当を行なう。すべての移動機からの確認信号を受信した時点で割当変更は終了する。なお、移動機からのＡＣＫ／ＮＡＣＫ信号はユーザデータスロットに多重化しても構わない。また、スロットの解放を行う場合には、解放確認信号が移動機から受信されるまでは、当該スロットを解放状態とはしない。即ち、解放状態前に当該スロットを他の移動機に割当てることはしない。これはスロット数にて管理する場合にも同様の扱いである。

【００３８】次に、図１１を用いて基地局における割当スロット数の増減処理について説明する。基地局は上り制御チャネルを用いて各移動機からの送信キュー長の報告を受信する（Ｓ０７０１）。各移動機の送信キュー長が閾値（Ｘｉ）を超えている場合には、送信キュー長の増分（ｘ―Ｘｉ）に対応するスロット数Ｎｚｐを算出し（Ｓ０７０３）、その移動機の割当変更可能スロット数に加算する（Ｓ０７０４）。以降は実施の形態２で示した各フレームにおける移動機に対する送信スロット通知と同様の処理（Ｓ０４０４～Ｓ０４１５）にてその移動機に対して割当てスロット位置を通知する（Ｓ０７０８）。また、送信キュー長が閾値（Ｘｄ）以下の場合には、送信キュー長さの減少分（Ｘｄ－ｘ）に対応するスロット数Ｎｚｍを算出し（Ｓ０７０６）、その移動機の割当変更可能スロット数から減算する。なお、その移動機に対して、呼設定時に割当変更可能スロットとしてスロット番号が通知されている場合には、基地局は割り当てたスロットの中でスロット番号が大きい順に解放スロットを選択し（Ｓ０７０７）、下り制御チャネルにてその移動機に通知する（Ｓ０７０８）。また、各フレームにおいて移動機に対して使用するスロットを報知する方法を採用している場合には、その移動機に対する割当変更可能スロット数を変更する。この場合には増加させる場合には呼受け付け時の処理を、減少させる場合には呼切断時の処理を用いる。

【００３９】この方法によれば、移動機の送信キューに対応して割当スロット数を増減させることが可能であり、移動機からの送信キュー報告周期に依存した遅延時間で送信キューに追随して割当スロット数を変更できるので、各移動機のトラフィックに遅れなく即応したスロット割当ができる。

【００４０】実施の形態５．図１３は、本発明の実施の形態５における可変スロット割当方法のスロット解放を示すシーケンス図であり、図１４は可変スロット割当方法のスロット解放処理のフロー図である。以下、図１、及び図１３～１４を用いて本実施の形態における可変スロット割当方法を説明する。

【００４１】従来例でも説明したように、基地局において受信データに対してN回連続で受信未確認（ＮＡＫ）を送信すると、割当スロットを解放することができるが、移動機がN回連続送信し、基地局がN回連続で無線区間の誤り等によるデータ受信を失敗した場合にも割当

スロットを解放してしまう。ここでは、図１３に示したように、移動機は送信データが無い場合の割当変更可能スロットでの送信を停止する（図１３では＃３のみ）。こうすれば、基地局は当該スロットの同期を取ることが出来ないので同期はずれとなり、ＣＲＣでのエラーとは異なる指標を得ることができる。例えば、基地局は同期外れを連続Ｎ回観測したスロットはＮ回目の同期外れを起こしたフレームの次のフレームの下り制御チャネルにて当該フレームにおける割当変更可能スロットを解放する通知を当該移動機に対して送信する。この方法は、予め移動機に対して固定の送信スロットを設定する方法すべてに用いることが出来る。また、各フレームにおいて送信スロットを報知する方法の場合の通知には、送信スロット数（実施の形態１～４では割当変更可能スロット数）に対応したスロット位置（番号）の選択の際に応用することができる。

【００４２】図１４を用いて基地局における同期外れによるスロット解放処理について説明する。移動機からの送信キュー長報告を調べ（Ｓ０８０１）、送信キュー長（Ｌｑ）が閾値（Ｘｐ）よりも短い場合には（Ｓ０８０２：Ｎｏ）、以下の処理を行う。まず、基地局は同期はずれを起こしたスロット番号を記憶し（Ｓ０８０５）、当該スロットの前フレームでの状態を検査する。前フレームでの状態も同期外れの場合には同期はずれ回数（ＡＳ）をカウントアップする（Ｓ０８０８）。なお、当該スロット以外の前フレームでの状態ならびに同期外れ回数はリセットしておく（Ｓ０８０６）。同期外れ回数が閾値Ｎよりも大きい場合には、割当変更可能スロット数を当該スロット数分減少させる（Ｓ０８０９）。ただし、送信キュー長Ｌｑが閾値Ｘｐよりも長く、かつ同期はずれが頻発する場合には、無線回線品質の悪化と考えられるので、割当変更可能スロット数の変更は実施しない（Ｓ０８０４）。この方法によれば、移動機は送信データが無い場合には当該スロットでの送信を一切行わず（アイドル信号も送信しない）、送信パワーを落とす。こうして、基地局は当該フレームの当該スロットは同期外れとなり、その移動機からの送信がなかったことが分かる。従って、複数フレームにわたり送信データのなかったスロットを、その移動機の割当スロットから解放できる。また、制御情報が途中で誤ってしまったため割当変更可能スロットの解放が実施できない場合でも、移動機からの送信データが無ければ、基地局が自律的にスロットを解放し、回線利用効率を向上させられる。

【００４３】実施の形態６．図１５は本発明の実施例６における送信バッファのキュー長に基づいて補助的にスロット割当変更を行なう方法を示すシーケンス図であり、図１６はそのスロット割当変更処理フロー図である。以下、図１及び図１５～１６を用いて本実施の形態におけるスロット割当変更方法を説明する。

【００４４】基地局は、図１５に示すように、移動機からの送信キュー長（ｘ）を各フレームないし規定フレーム数（ｎフレームに１回）毎に受信する。実施の形態４では、基地局は受信した送信キュー長に基づき、移動機に対する割当変更可能スロット数の増減方法を説明した。この実施の形態４の方法では、二つの閾値（Ｘｉ、Ｘｄ）の関係がＸｄ＜ｘ＜Ｘｉであれば、スロット割当の変更は実行されない。しかし、移動機における送信キューに対する入力トラフィックの変動が大きい場合、すなわちピークビットレートと平均ビットレートの差が大きい場合や、バースト性が強い入力トラフィックの場合には、割当変更が頻繁に起こることになる。そうすると、送信データがない状態や、送信バッファにデータ溜まる状態が繰り替えされ、サービス品質が守れない場合がある。また、適切な閾値を基地局が選択できない場合にも同様の状態となる。さらに、頻繁に移動機に対する割当変更スロット数の変更を増大させると基地局の負荷ならびに、他の移動機への割当スロット数の変動が大きくなる。本実施の形態ではこれらの状況に対処するために、基地局は特定の各移動機の単位時間Ｔの間に発生した割当て変更回数を計測し、割当て変更回数がＮ回以上となった移動機の送信キュー長用閾値（Ｘｉ、Ｘｄ）の間隔を広げて、割当変更頻度を減少させる。

【００４５】図１６を用いて、この割当変更頻度適切化処理を説明する。基地局は移動機から送信キュー長報告を受信した場合には、（Ｓ０９０１）移動機毎に持つタイマをチェックする（Ｓ０９０２）。タイマが稼動している場合には、送信キュー長が閾値ＸｄとＸｉの中（Ｘｄ＜Ｌｑ＜Ｘｉ）にあるか否かを検査し（Ｓ０９０５）、閾値外にある場合には実施の形態４で示した方法によりその移動機に対して割当変更可能スロット数の増加または減少を実施し、回数カウンタ値を加算する（Ｓ０９０６）。また、タイマが稼動していない場合にはタイマを稼動し（Ｓ０９０３）、カウンタ値をリセットする（Ｓ０９０４）。次に、タイマ稼働中にカウンタ値がＮ以上になった場合はＴ時間以内にＮ回の割当変更があったことになるため、閾値ＸｄとＸｉをそれぞれＸｄ＝Ｘｄ－ａｍ、Ｘｉ＝Ｘｉ＋ａｎに変化させ（Ｓ０９０８）、送信キュー長が許容される値の幅を増加させ（Ｓ０９０８）、受信タイマをリセットする（Ｓ０９０９）結果として割当変更可能スロット数自体の変更頻度を減少させることができる。この方法によれば、割当て変更回数の頻度を低減できる為、トラフィック変動周期の激しい呼に対してもピークトラフィックに近づく傾向をとり伝送遅延なくデータ送信ができる。さらに、呼毎に割当変更用の閾値が決まるため、閾値の適正化も動的に行われることとなり、バースト性の高いトラフィックのための閾値の設定のような特例を設けることなく処理が実装できる。

【００４６】実施の形態７．図１７は本発明の実施の形態７におけるＡＲＱの再送要求を用いたスロット割当変

更を行うシーケンス図であり、図１８はそのスロット割当変更処理を示すフロー図である。以下、図１７ならびに図１８を用いて本実施の形態における可変スロット割当方法を説明する。

【００４７】基地局と移動局との間でＡＲＱが実施されている場合の図１７に示すシーケンス図は、移動機から送出されたデータ（１～６）のうち、Ｎｏ．２、３、５のデータに誤りが発生した様子を示している。ＡＲＱが実施されている場合は、受信データに誤りがあれば、少なくとも当該フレームでのデータは再送のために送信側（移動機）で送信バッファに溜まっている。そこで、基地局側では、再送要求のためのデータ（シーケンス番号など）から算出される再送データ数を元に、送信側キュー長用の閾値（Ｘｄ）を減らすことにより、割当スロット数の増加を迅速に行うことができる。

【００４８】図１８を用いて、再送制御（例えばＡＲＱ）を実施している基地局での割当スロット変更処理について説明する。基地局が移動機からのスロットを受信すると（Ｓ１００１）、各スロットに付されたＣＲＣ（Ｃｙｃｌｉｃ Ｒｅｄｕｎｄａｃｙ Ｃｈｅｃｋ）を計算し（Ｓ１００２）、当該スロットでの誤りの有無を検査する（Ｓ１００３）。但し、図１８ではスロット単位にＣＲＣが付されている条件で記載しているが、スロット内のデータユニット単位にＣＲＣが付与されていることもある。受信スロットに誤りが検出された場合には、その誤りが検出されたスロット番号を記憶し（Ｓ１００５）、誤りのあったスロット数（ｍ）を算出する（Ｓ１００６）。ここで、ｍが閾値（ａ０）よりも大きい場合には、対応する移動局の割当変更可能スロットを増大させることになったＸｉをａだけ減少させる（実施の形態３、４で述べた）（Ｓ１００８）。このように、Ｘｉを減少させると、次の移動機からの送信キュー長報告における移動機のキュー長（ｘ）の増加に対して、割当変更可能スロット数の増加処理が速やかに進む。この方法によれば、再送のための送信バッファのキュー長が伸びるので、移動機のキュー長の増大に対して短時間で割当てスロットが増加し、再送による送信遅延を軽減できる。

【００４９】

【発明の効果】上述したようにこの発明の方法によれば、以下の効果がある。移動機からの最低伝送速度対応の固定スロットを割り当てるので、各移動機は必要な通信を確保できる効果があり、更に余裕がある場合はフレーム毎に即応して要求品質の伝送が出来て回線効率が向上する効果がある。

【００５０】また更に、切断により可変スロットに空きが出来ると再割当をするようにしたので、トラフィックの変動に即応して伝送速度を向上できる効果がある。

【００５１】また更に、割当リストを用いるので、可変スロットの割当が迅速に出来る効果がある。

【００５２】また更に、可変スロットの確保に際しては中間品質を考慮したので、伝送を行っている各移動機がその要求品質に応じて平等に可変スロットを確保できる効果がある。

【００５３】また更に、再発呼要求で可変スロットを再確保するようにしたので、状況変化に即応して伝送速度を変更できる効果がある。

【００５４】また更に、移動機から現用スロット数も報告するようにしたので、基地局での再評価時間が短縮されて即応性が向上する効果がある。

【００５５】また更に、各移動機は伝送が必要な現在送信データ量対応の情報を報告するようにしたので、きめ細かい伝送速度の設定を遅れなく行える効果がある。

【００５６】また更に、解放確認信号の受信までは可変スロットを解放しないので、不用意な回線切断を防ぐ効果がある。

【００５７】また更に、同期外れとその他の原因を区別するようにしたので、伝送データがない場合の同期外れでは可変スロットを他に渡して有効利用が出来る効果がある。

【００５８】また更に、移動機への可変スロットの増減指示回数を監視するので、対応する移動機の伝送速度を適切に抑えて制御回線のトラフィック量を削減し、かつ回線の利用効率を向上させる効果がある。

【００５９】また更に、移動機からのデータの誤り量を検出して再送が必要な移動機は可変スロットを増加させるようにしたので、誤りがあった移動機は伝送時間を短縮できる効果がある。

【図面の簡単な説明】

【図１】　本発明におけるＴＤＭＡフレーム構成の例を示す図である。

【図２】　本発明の実施の形態１における基地局によるスロット割当の処理フロー図である。

【図３】　実施の形態１において基地局が行うフレーム毎のスロット割当変更処理フロー図である。

【図４】　実施の形態１において切断要求に基くスロット割当変更処理フロー図である。

【図５】　本発明における各フレームでのスロット割当状況の例を示す図である。

【図６】　本発明の実施の形態２における基地局によるスロット割当の処理フロー図である。

【図７】　実施の形態２において基地局が行うフレーム毎のスロット割当変更処理フロー図である。

【図８】　実施の形態２におけるフレームでのスロット割当状況の例を示す図である。

【図９】　本発明の実施の形態３における基地局によるスロット割当の処理フロー図である。

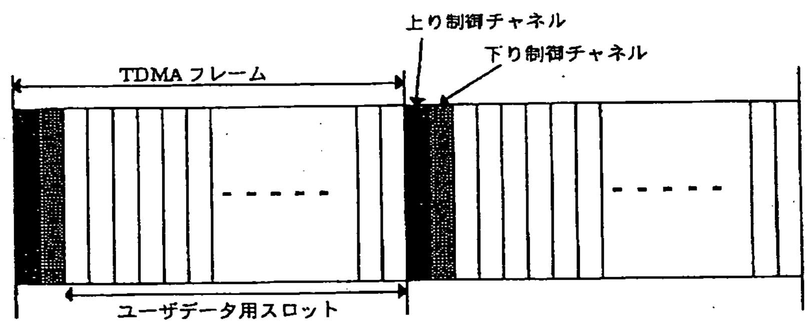
【図１０】　実施の形態３におけるスロット再割当のシーケンスの例を示す図である。

【図１１】　本発明の実施の形態４における基地局によ

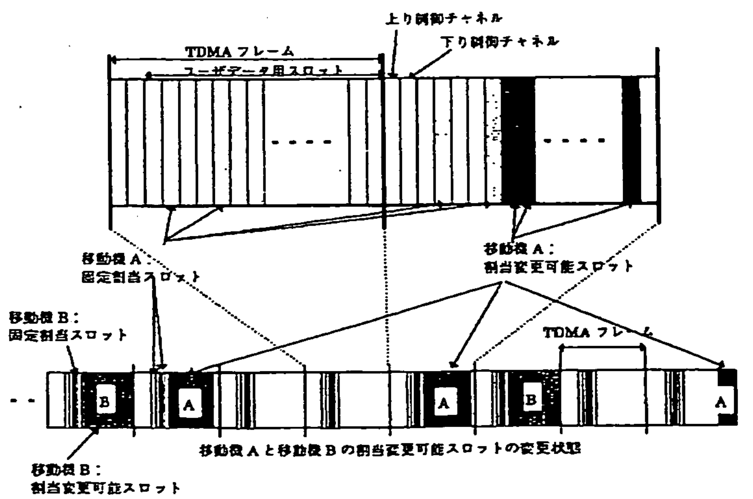
るスロット割当の処理フロー図である。
【図１２】　実施の形態４におけるスロット割当のシーケンスの例を示す図である。
【図１３】　本発明の実施の形態５における可変スロット割当のシーケンスの例を示す図である。
【図１４】　本発明の実施の形態５における基地局によるスロット割当の処理フロー図である。
【図１５】　本発明の実施の形態６における可変スロット割当のシーケンスの例を示す図である。
【図１６】　本発明の実施の形態６における基地局によるスロット割当の処理フロー図である。
【図１７】　本発明の実施の形態７における可変スロット割当のシーケンスの例を示す図である。
【図１８】　本発明の実施の形態７における基地局によるスロット割当の処理フロー図である。
【図１９】　第１の従来例におけるＴＤＭＡフレームの構成図である。
【図２０】　第１の従来例における可変スロット割当の＊

＊処理フロー図である。
【図２１】　第２の従来例における可変スロット方式のスロット解放シーケンスの例を示す図である。
【符号の説明】
Ｓ０１０３　最低品質を満たすスロット数算出ステップ、Ｓ０１０４　要求品質を満たすスロット数算出ステップ、Ｓ０１０５　可変スロット数算出ステップ、Ｓ０１０８　固定スロット確保ステップ、Ｓ０１１０　可変スロット確保ステップ、Ｓ０１１２　可変スロット確保ステップ、Ｓ０３０１　切断受付ステップ、Ｓ０３０４　可変スロット見直し確認ステップ、Ｓ０３０７　可変スロット見直し確認ステップ、Ｓ０５０２　要求品質を満たすスロット数算出ステップ、Ｓ０５０３　中間可変スロット確認ステップ、Ｓ０５０５　可変スロット確保ステップ、Ｓ０６０１　再発呼要求受付ステップ、Ｓ０６０３　スロット増分数算出ステップ、Ｓ０６０４　可変スロット増分確保ステップ、Ｓ０８０８　同期外れ数検出ステップ、Ｓ１００７　誤り回数検出ステップ。

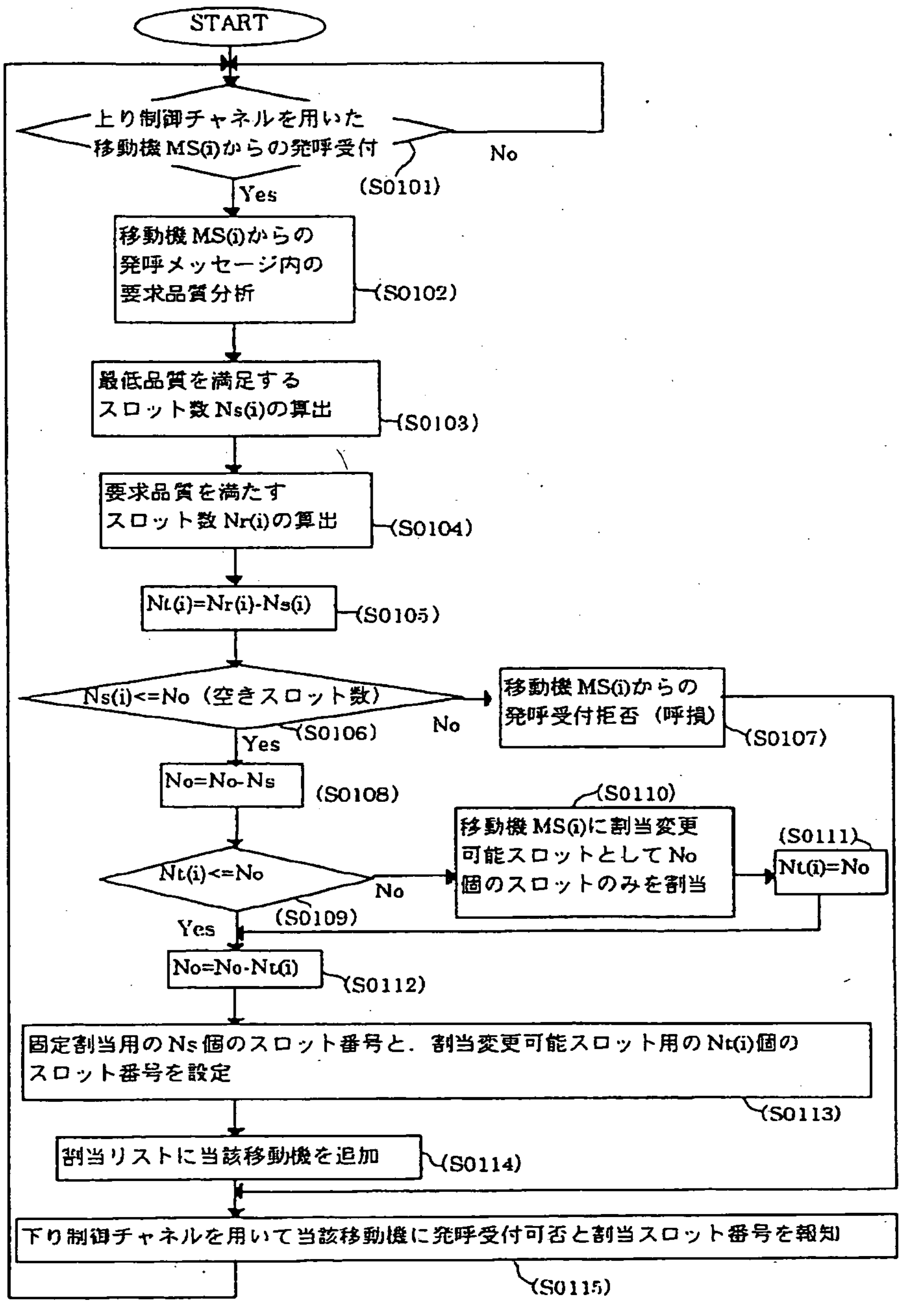
【図１】



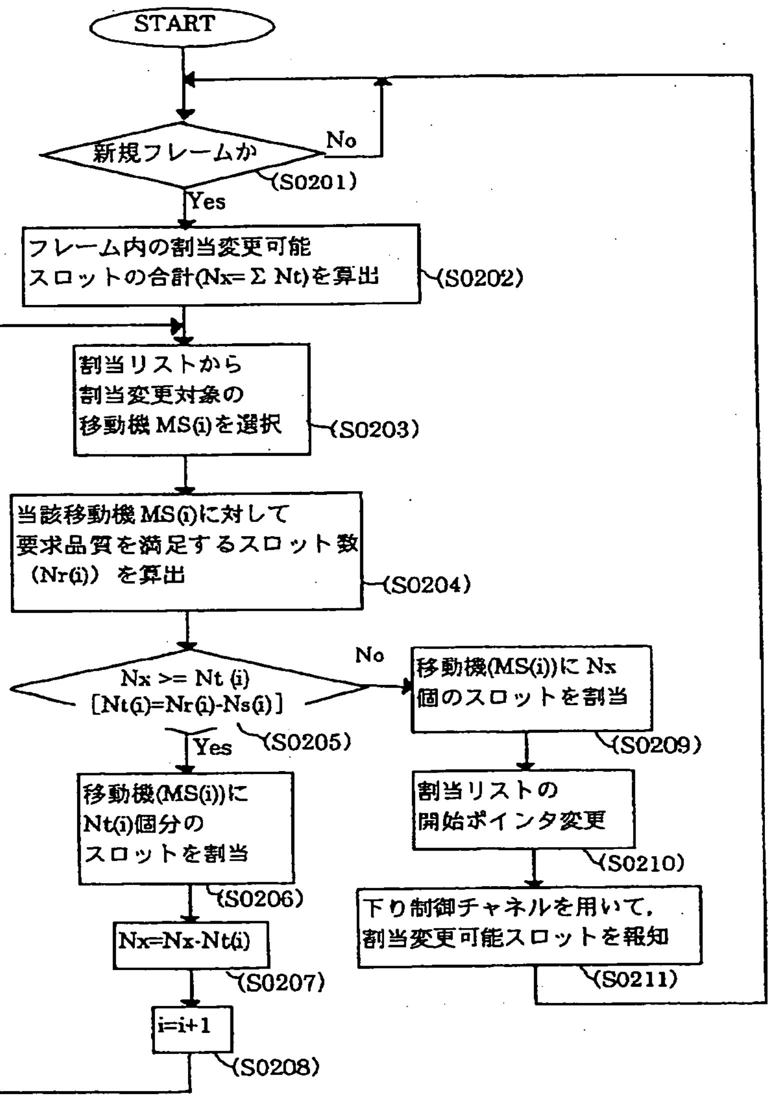
【図５】



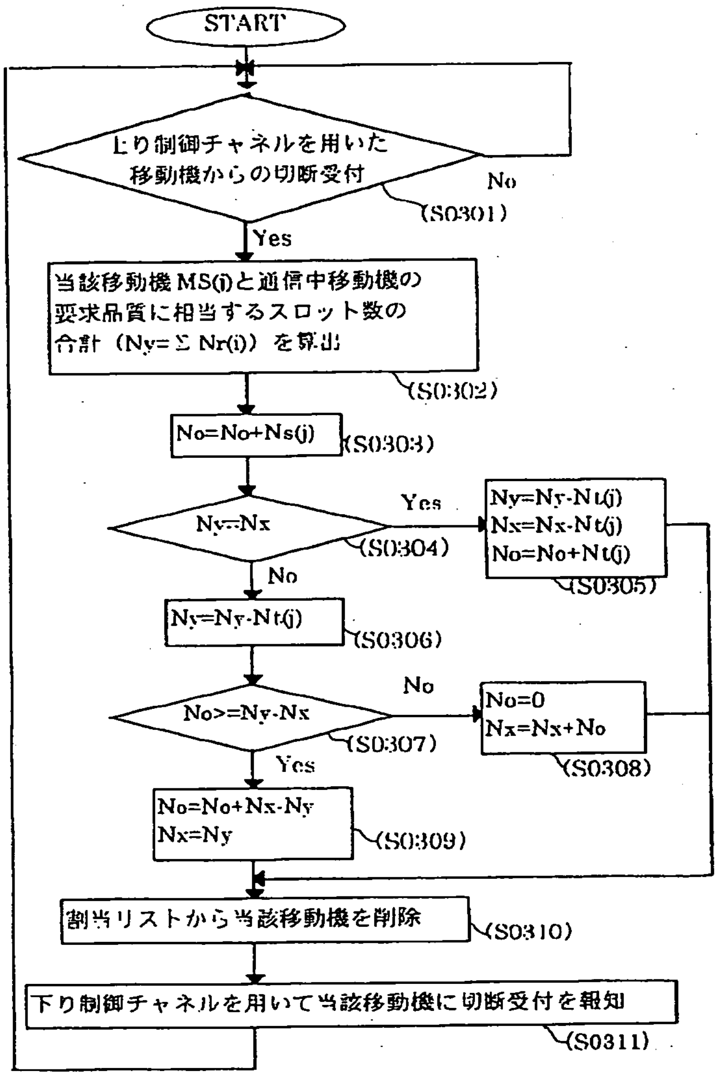
【図2】


START
上り制御チャネルを用いた
移動機MS(i)からの発呼受付
(S0101)
No
Yes
移動機MS(i)からの
発呼メッセージ内の
要求品質分析
(S0102)
最低品質を満足する
スロット数Ns(i)の算出
(S0103)
要求品質を満たす
スロット数Nr(i)の算出
(S0104)
Nt(i)=Nr(i)-Ns(i)
(S0105)
Ns(i)<=No（空きスロット数）
(S0106)
No
移動機MS(i)からの
発呼受付拒否（呼損）
(S0107)
Yes
No=No-Ns
(S0108)
(S0110)
移動機MS(i)に割当変更
可能スロットとしてNo
個のスロットのみを割当
(S0111)
Nt(i)=No
Nt(i)<=No
No
(S0109)
Yes
No=No-Nt(i)
(S0112)
固定割当用のNs個のスロット番号と、割当変更可能スロット用のNt(i)個の
スロット番号を設定
(S0113)
割当リストに当該移動機を追加
(S0114)
下り制御チャネルを用いて当該移動機に発呼受付可否と割当スロット番号を報知
(S0115)

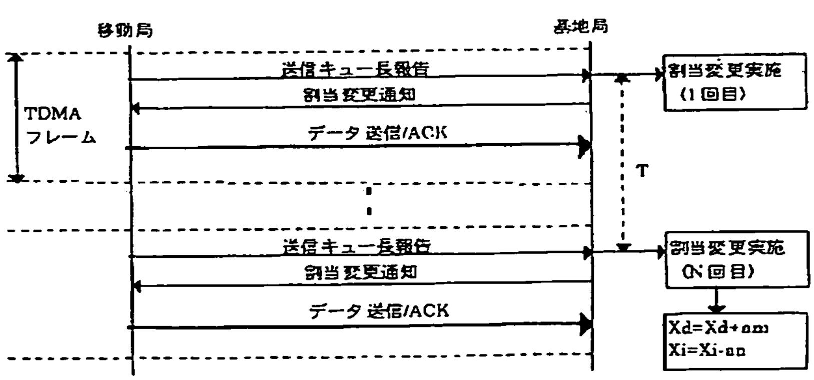
【図3】


START
新規フレームか
No
(S0201)
Yes
フレーム内の割当変更可能
スロットの合計(Nx=Σ Nt)を算出
(S0202)
割当リストから
割当変更対象の
移動機 MS(i)を選択
(S0203)
当該移動機 MS(i)に対して
要求品質を満足するスロット数
(Nr(i)) を算出
(S0204)
No
Nx >= Nt (i)
[Nt(i)=Nr(i)-Ns(i)]
(S0205)
Yes
移動機(MS(i))に
Nt(i)個分の
スロットを割当
(S0206)
Nx=Nx-Nt(i)
(S0207)
i=i+1
(S0208)
移動機(MS(i))に Nx
個のスロットを割当
(S0209)
割当リストの
開始ポインタ変更
(S0210)
下り制御チャネルを用いて,
割当変更可能スロットを報知
(S0211)

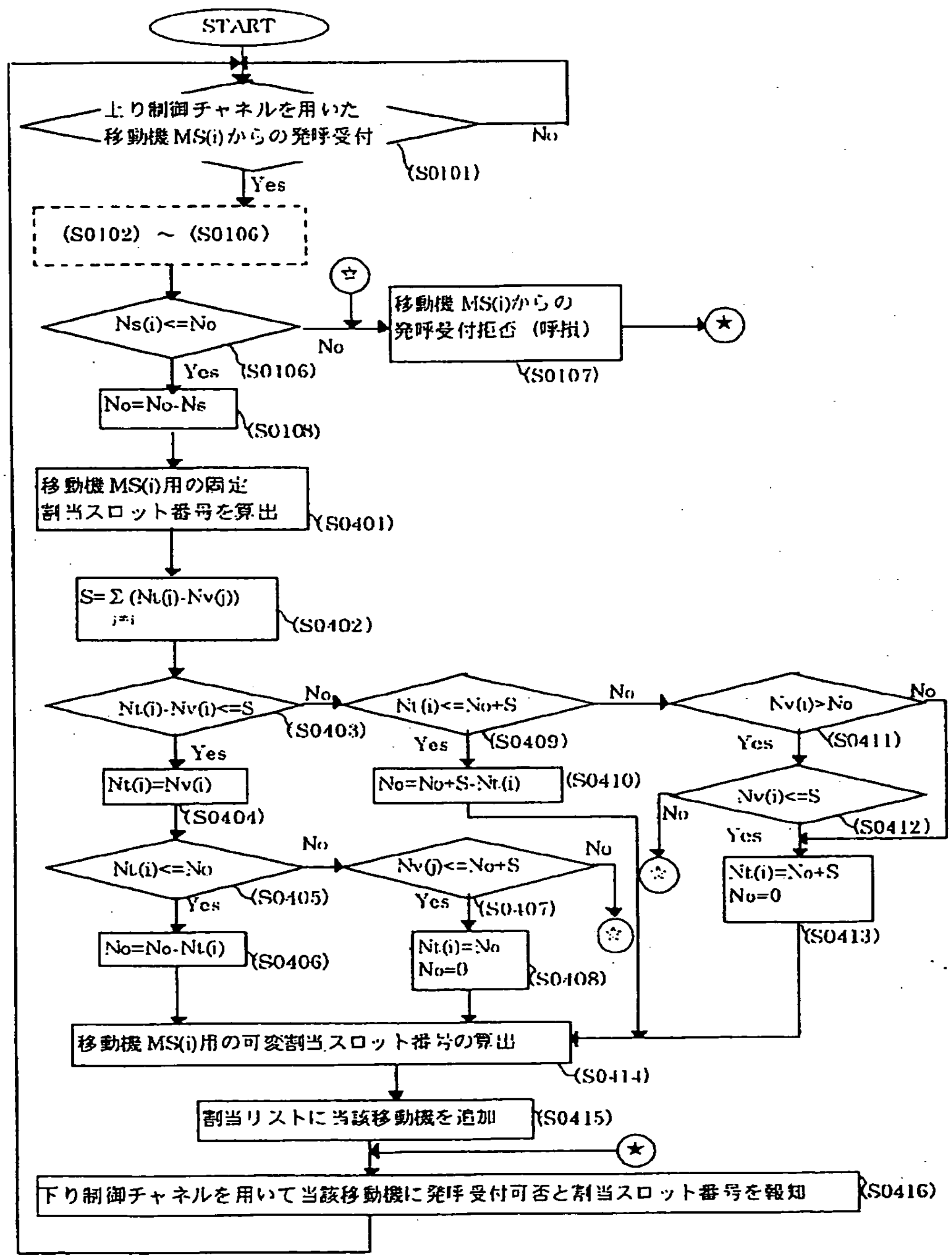
【図4】


START
上り制御チャネルを用いた移動機からの切断受付
No
(S0301)
Yes
当該移動機MS(j)と通信中移動機の要求品質に相当するスロット数の合計（Ny=Σ Nr(i)）を算出
(S0302)
No=No+Ns(j)
(S0303)
Ny=Nx
(S0304)
Yes
Ny=Ny-Nt(j)
Nx=Nx-Nt(j)
No=No+Nt(j)
(S0305)
No
Ny=Ny-Nt(j)
(S0306)
No>=Ny-Nx
(S0307)
No
No=0
Nx=Nx+No
(S0308)
Yes
No=No+Nx-Ny
Nx=Ny
(S0309)
割当リストから当該移動機を削除
(S0310)
下り制御チャネルを用いて当該移動機に切断受付を報知
(S0311)

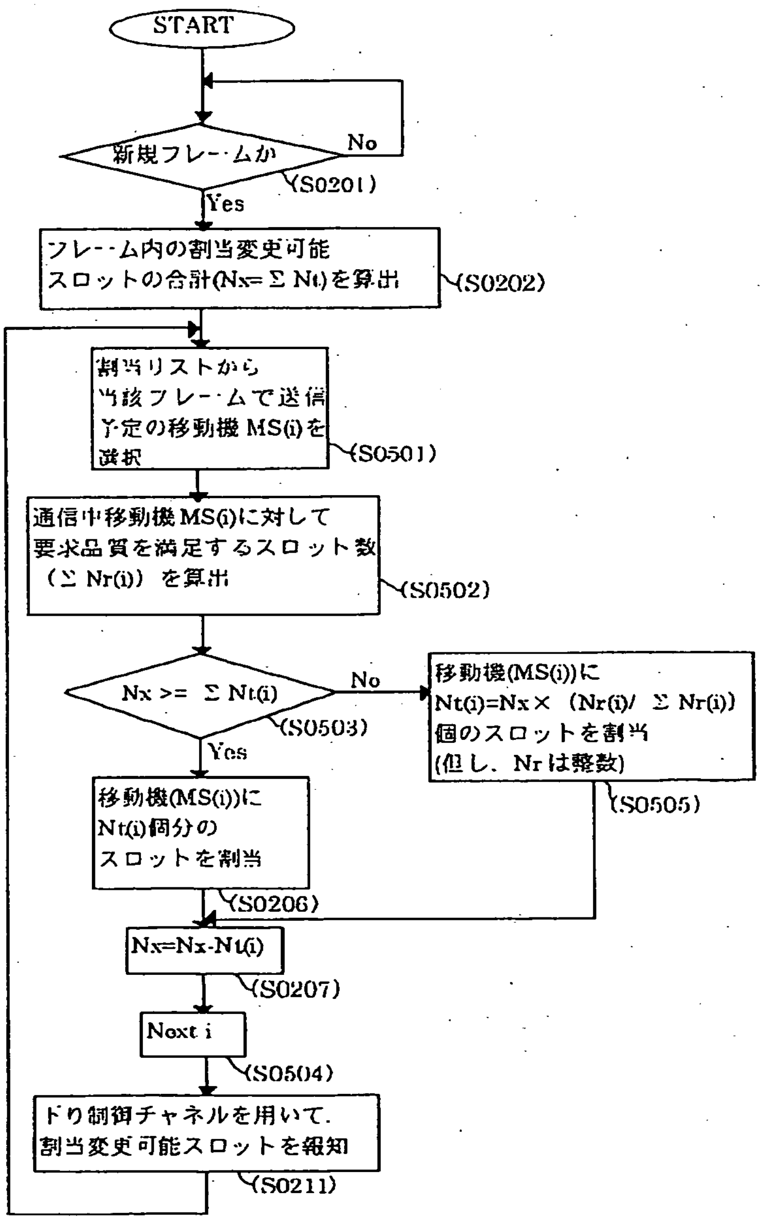
【図15】


移動局
基地局
TDMA
フレーム
送信キュー長報告
割当変更通知
データ送信/ACK
割当変更実施
(1回目)
T
送信キュー長報告
割当変更通知
データ送信/ACK
割当変更実施
(N回目)
Xd=Xd+αm
Xi=Xi-αn

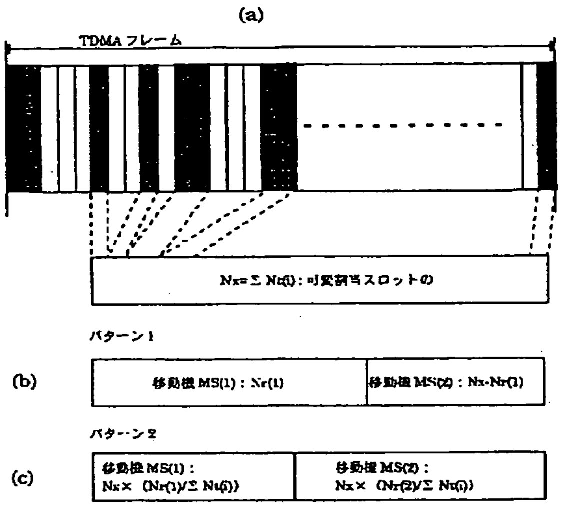
【図６】


START
上り制御チャネルを用いた移動機MS(i)からの発呼受付
No
Yes
(S0101)
(S0102) ～ (S0106)
Ns(i)<=No
No
Yes
(S0106)
移動機MS(i)からの発呼受付拒否（呼損）
(S0107)
No=No-Ns
(S0108)
移動機MS(i)用の固定割当スロット番号を算出
(S0401)
S=Σ(Nt(j)-Nv(j)) j≠i
(S0402)
Nt(i)-Nv(i)<=S
(S0403)
Nt(i)<=No+S
(S0409)
Nv(i)>No
(S0411)
Nt(i)=Nv(i)
(S0404)
No=No+S-Nt(i)
(S0410)
Nv(i)<=S
(S0412)
Nt(i)<=No
(S0405)
Nv(j)<=No+S
(S0407)
Nt(i)=No+S
No=0
(S0413)
No=No-Nt(i)
(S0406)
Nt(i)=No
No=0
(S0408)
移動機MS(i)用の可変割当スロット番号の算出
(S0414)
割当リストに当該移動機を追加
(S0415)
下り制御チャネルを用いて当該移動機に発呼受付可否と割当スロット番号を報知
(S0416)

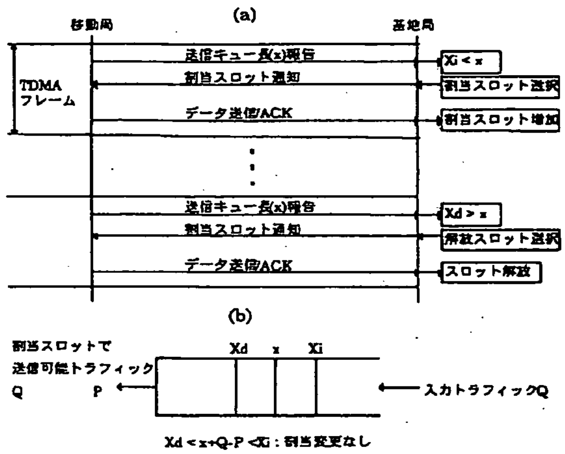
【図7】


START
新規フレームか
No
(S0201)
Yes
フレーム内の割当変更可能
スロットの合計(Nx=ΣNt)を算出
(S0202)
割当リストから
当該フレームで送信
予定の移動機MS(i)を
選択
(S0501)
通信中移動機MS(i)に対して
要求品質を満足するスロット数
(ΣNr(i))を算出
(S0502)
Nx >= ΣNt(i)
No
(S0503)
Yes
移動機(MS(i))に
Nt(i)=Nx×(Nr(i)/ΣNr(i))
個のスロットを割当
(但し、Nrは整数)
(S0505)
移動機(MS(i))に
Nt(i)個分の
スロットを割当
(S0206)
Nx=Nx-Nt(i)
(S0207)
Next i
(S0504)
下り制御チャネルを用いて、
割当変更可能スロットを報知
(S0211)

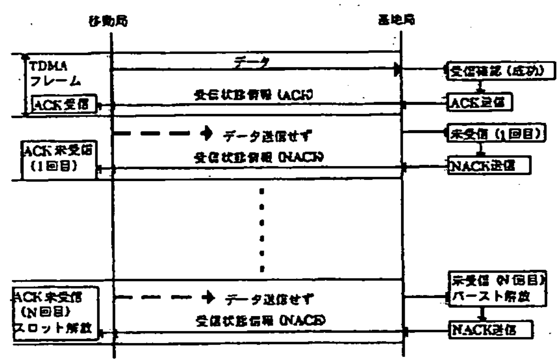
【図8】


(a)
TDMA フレーム
Nx=Σ Nt(i)：可変割当スロットの
パターン1
(b)
移動機 MS(1)：Nr(1)
移動機 MS(2)：Nx-Nr(1)
パターン2
(c)
移動機 MS(1)：
Nx×（Nr(1)/Σ Nt(i)）
移動機 MS(2)：
Nx×（Nr(2)/Σ Nt(i)）

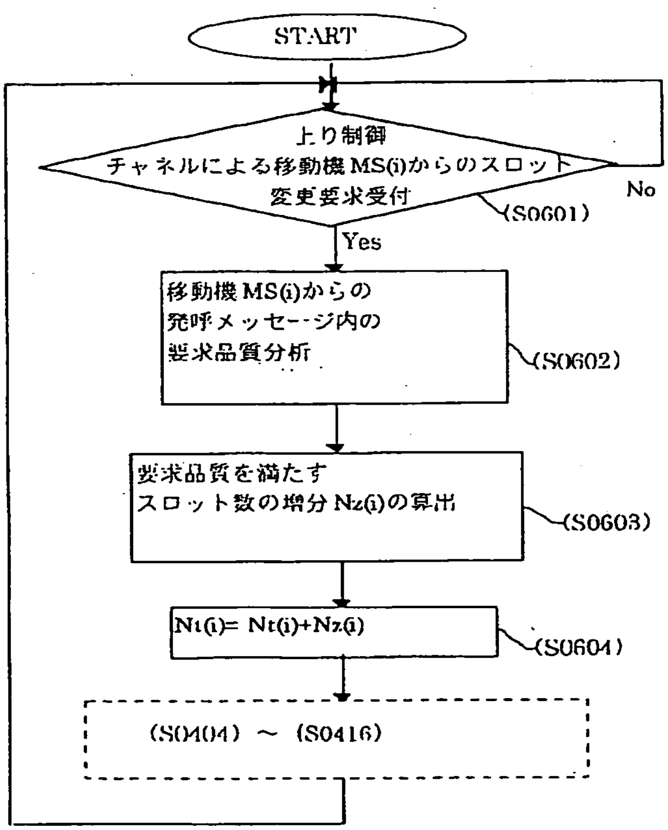
【図12】


(a)
移動局
基地局
TDMA
フレーム
送信キュー長(x)報告
割当スロット通知
データ送信/ACK
Xi < x
割当スロット選択
割当スロット増加
Xd > x
解放スロット選択
スロット解放
(b)
割当スロットで
送信可能トラフィック
Q
P
Xd
x
Xi
入力トラフィックQ
Xd < x+Q-P < Xi：割当変更なし

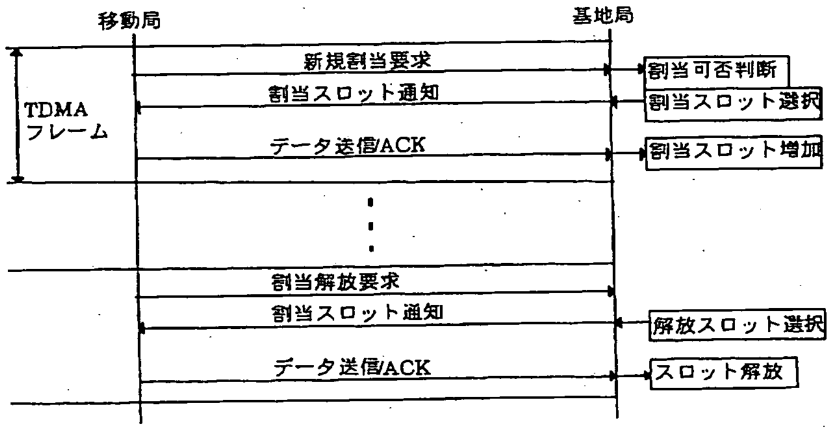
【図21】


移動局
基地局
TDMA
フレーム
データ
受信確認（成功）
受信状態情報（ACK）
ACK受信
ACK送信
データ送信せず
未受信（1回目）
ACK未受信
（1回目）
受信状態情報（NACK）
NACK送信
データ送信せず
未受信（N回目）
バースト解放
ACK未受信
（N回目）
スロット解放
受信状態情報（NACK）
NACK送信

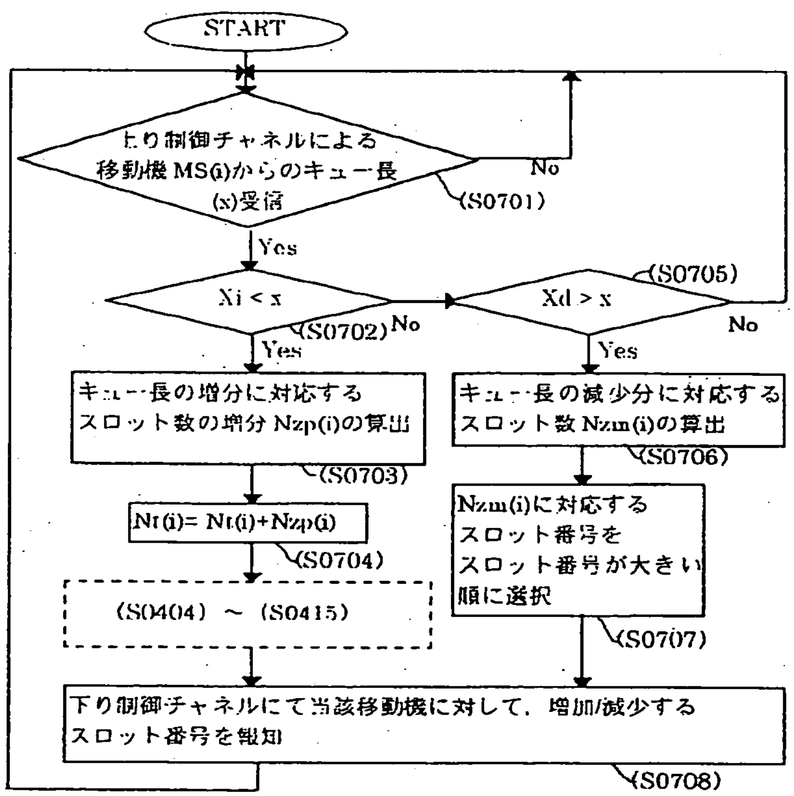
【図9】


START
上り制御
チャネルによる移動機MS(i)からのスロット
変更要求受付
(S0601)
No
Yes
移動機MS(i)からの
発呼メッセージ内の
要求品質分析
(S0602)
要求品質を満たす
スロット数の増分Nz(i)の算出
(S0603)
Nt(i)= Nt(i)+Nz(i)
(S0604)
(S0404) ～ (S0416)

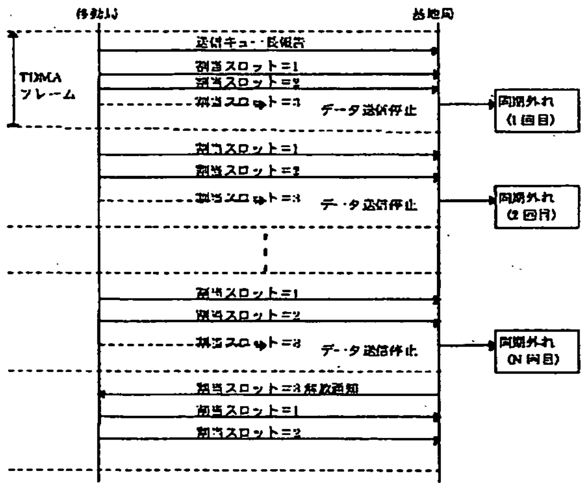
【図10】


移動局
基地局
TDMA
フレーム
新規割当要求
割当可否判断
割当スロット通知
割当スロット選択
データ送信/ACK
割当スロット増加
割当解放要求
割当スロット通知
解放スロット選択
データ送信/ACK
スロット解放

【図11】

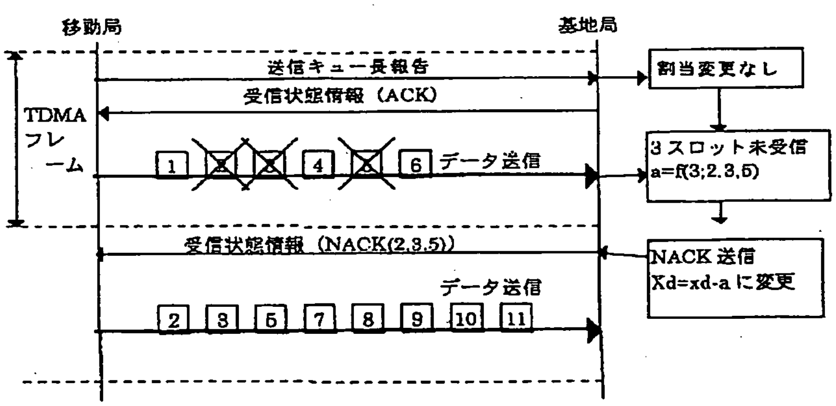

START
上り制御チャネルによる
移動機MS(i)からのキュー長
(x)受信
(S0701)
No
Yes
Xi < x
(S0702)
No
Xd > x
(S0705)
No
Yes
Yes
キュー長の増分に対応する
スロット数の増分Nzp(i)の算出
(S0703)
キュー長の減少分に対応する
スロット数Nzm(i)の算出
(S0706)
Nt(i)= Nt(i)+Nzp(i)
(S0704)
(S0404) ～ (S0415)
Nzm(i)に対応する
スロット番号を
スロット番号が大きい
順に選択
(S0707)
下り制御チャネルにて当該移動機に対して，増加/減少する
スロット番号を報知
(S0708)

【図13】



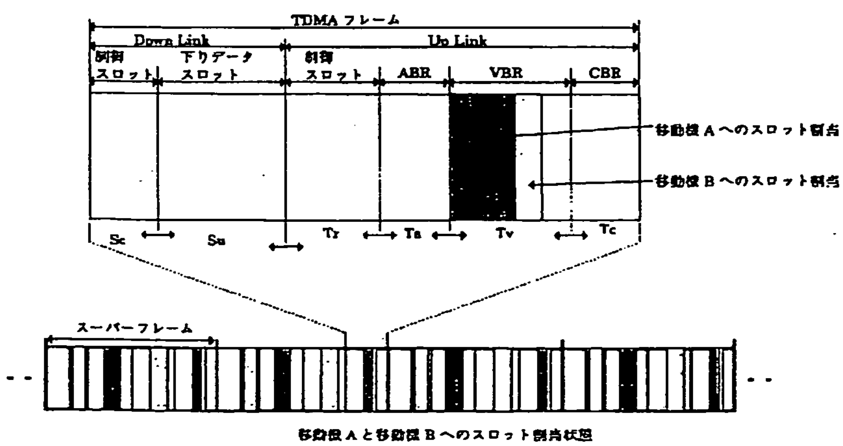
移動局
基地局
TDMA
フレーム
送信キュー長報告
割当スロット=1
割当スロット=2
割当スロット=3
データ送信停止
同期外れ
(1回目)
割当スロット=1
割当スロット=2
割当スロット=3
データ送信停止
同期外れ
(2回目)
割当スロット=1
割当スロット=2
割当スロット=3
データ送信停止
同期外れ
(N回目)
割当スロット=3解放通知
割当スロット=1
割当スロット=2

【図17】



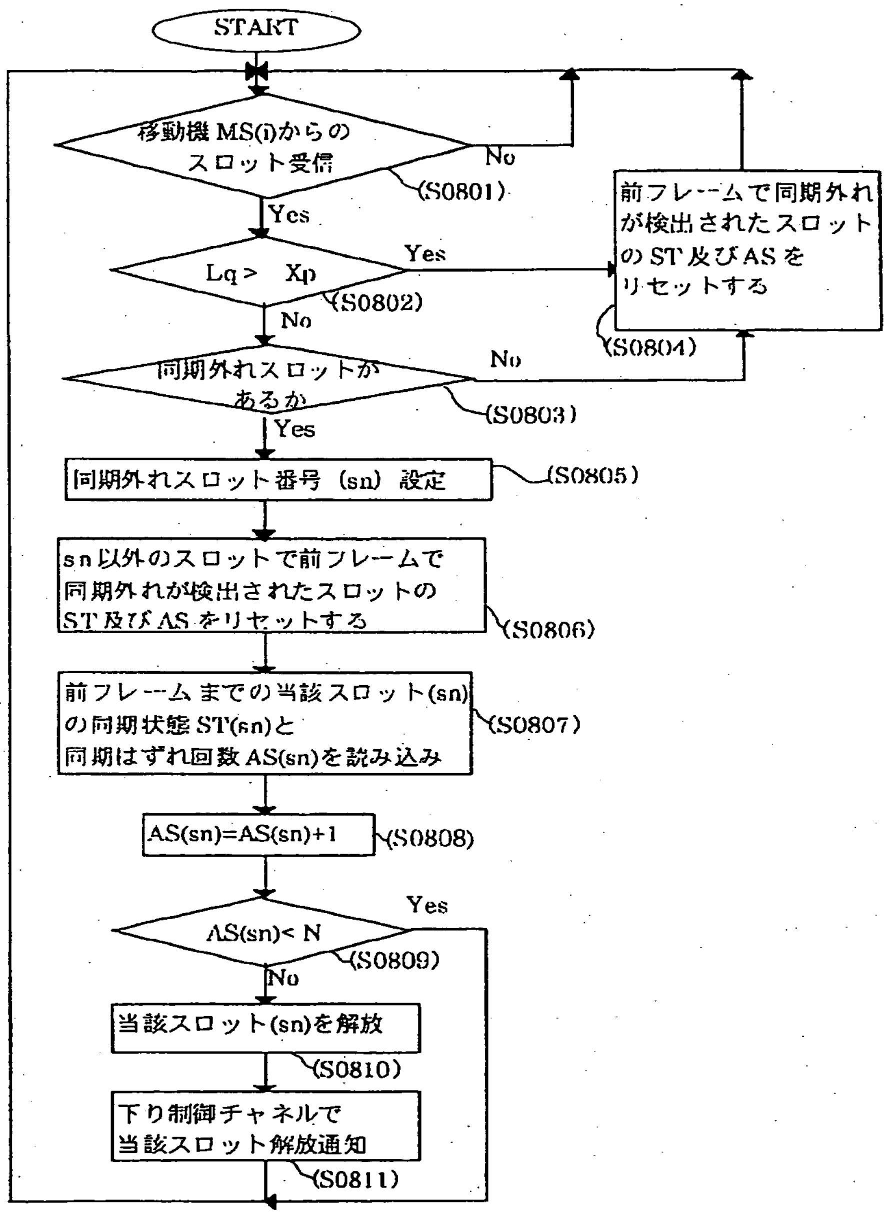
移動局
基地局
TDMA
フレ
ーム
送信キュー長報告
割当変更なし
受信状態情報（ACK）
1
4
6
データ送信
3スロット未受信
a=f(3;2,3,5)
受信状態情報（NACK(2,3,5)）
NACK 送信
Xd=xd-a に変更
データ送信
2
3
5
7
8
9
10
11

【図19】

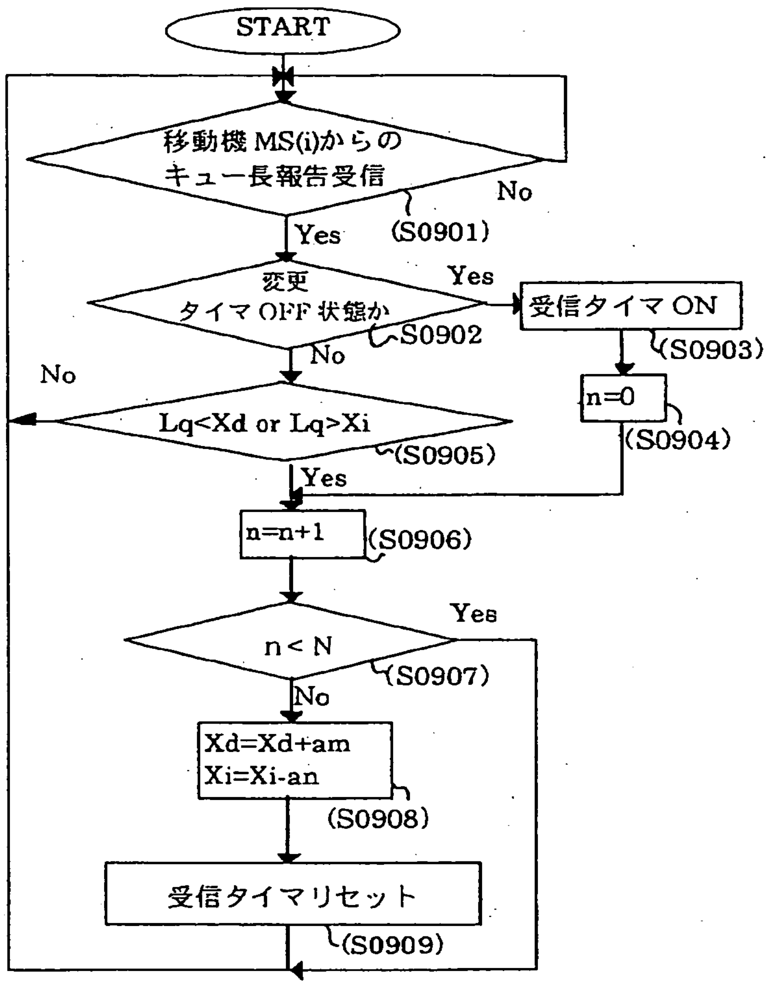


TDMA フレーム
Down Link
Up Link
制御
スロット
下りデータ
スロット
制御
スロット
ABR
VBR
CBR
移動機Aへのスロット割当
移動機Bへのスロット割当
Sc
Su
Tr
Ta
Tv
Tc
スーパーフレーム
移動機Aと移動機Bへのスロット割当状態

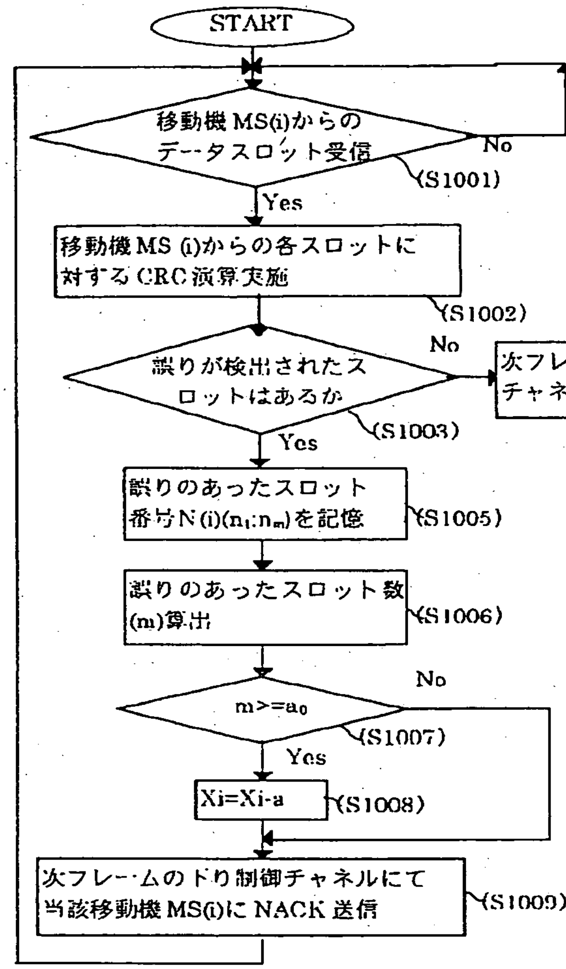
【図14】


START
移動機MS(i)からの
スロット受信
(S0801)
No
Yes
Lq＞ Xp
(S0802)
Yes
No
前フレームで同期外れ
が検出されたスロット
のST及びASを
リセットする
(S0804)
同期外れスロットが
あるか
(S0803)
No
Yes
同期外れスロット番号（sn）設定
(S0805)
sn以外のスロットで前フレームで
同期外れが検出されたスロットの
ST及びASをリセットする
(S0806)
前フレームまでの当該スロット(sn)
の同期状態ST(sn)と
同期はずれ回数AS(sn)を読み込み
(S0807)
AS(sn)=AS(sn)+1
(S0808)
AS(sn)< N
(S0809)
Yes
No
当該スロット(sn)を解放
(S0810)
下り制御チャネルで
当該スロット解放通知
(S0811)

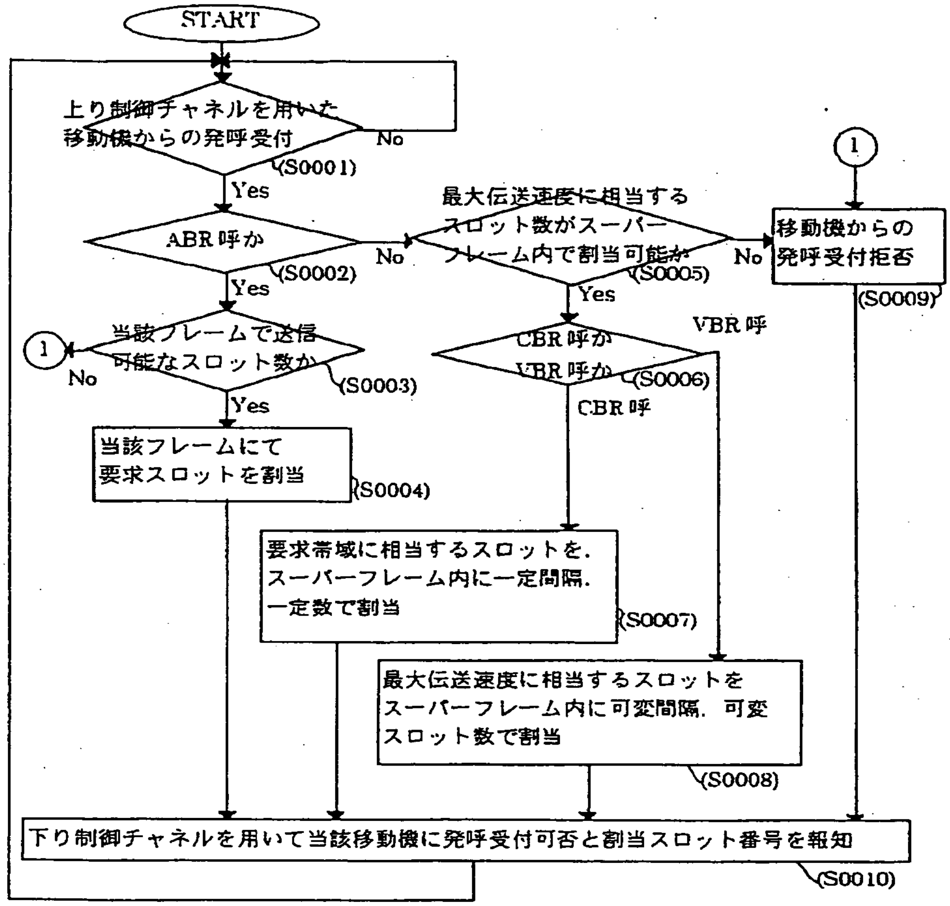
【図16】


START
移動機MS(i)からの
キュー長報告受信
No
Yes
(S0901)
変更
タイマOFF状態か
Yes
受信タイマON
S0902
No
(S0903)
No
n=0
Lq<Xd or Lq>Xi
(S0904)
(S0905)
Yes
n=n+1
(S0906)
Yes
n< N
(S0907)
No
Xd=Xd+am
Xi=Xi-an
(S0908)
受信タイマリセット
(S0909)

【図18】


START
移動機MS(i)からの
データスロット受信
No
(S1001)
Yes
移動機MS (i)からの各スロットに
対するCRC演算実施
(S1002)
No
誤りが検出されたス
ロットはあるか
(S1003)
次フレームの下り制御
チャネルにてACK送信
(S1004)
Yes
誤りのあったスロット
番号N (i)(n1:nm)を記憶
(S1005)
誤りのあったスロット数
(m)算出
(S1006)
No
m>=a0
(S1007)
Yes
Xi=Xi-a
(S1008)
次フレームの下り制御チャネルにて
当該移動機MS(i)にNACK送信
(S1009)

【図20】


START
上り制御チャネルを用いた移動機からの発呼受付
No
(S0001)
Yes
ABR呼か
No
(S0002)
Yes
当該フレームで送信可能なスロット数か
1
No
(S0003)
Yes
当該フレームにて要求スロットを割当
(S0004)
最大伝送速度に相当するスロット数がスーパーフレーム内で割当可能か
No
(S0005)
Yes
CBR呼かVBR呼か
VBR呼
(S0006)
CBR呼
要求帯域に相当するスロットを，スーパーフレーム内に一定間隔，一定数で割当
(S0007)
最大伝送速度に相当するスロットをスーパーフレーム内に可変間隔，可変スロット数で割当
(S0008)
1
移動機からの発呼受付拒否
(S0009)
下り制御チャネルを用いて当該移動機に発呼受付可否と割当スロット番号を報知
(S0010)